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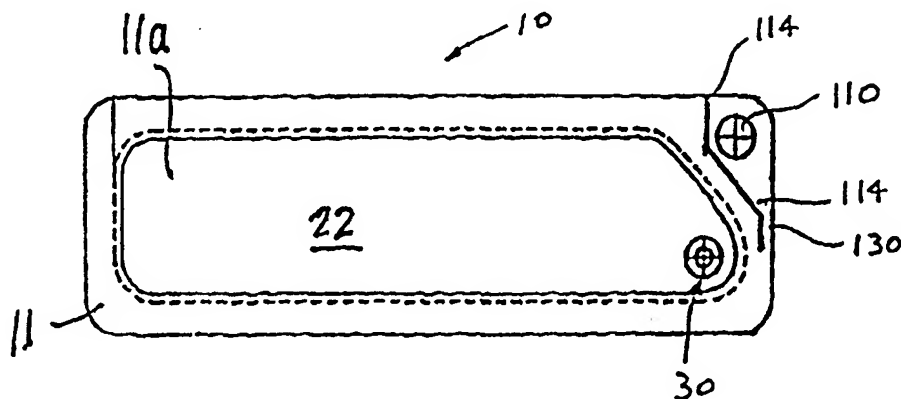
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(54) Title: TUBE LIKE DISPENSER PACKAGE AND INTEGRAL OUTLET FORMED FROM A SINGLE SHEET**(57) Abstract**

An aperture forming structure, which when attached to or integrally formed in dispenser packages for flowable substances allows reclosure and single or multiple uses. The aperture forming structure includes a break-away tip member (34) of thermoformable plastic. The break-away tip (34) includes a hollow protrusion (32) from a surface. The intersection of the hollow protrusion and the surface is a fault-line (114). Rupturing of the fault-line (114) creates an aperture from which the contents of the dispenser package may exit.

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TUBELIKE DISPENSER PACKAGE AND INTEGRAL OUTLET FORMED FROM A SINGLE SHEET

5 This application claims priority to provisional patent application serial no. 60/078,415, herein incorporated by reference.

FIELD OF THE INVENTION

10 This invention relates to easy opening, self-contained, easy to use, single or multiple use dispenser packages capable of economical, high speed production, manufactured from a broad range of materials, many of which are recyclable. They may contain such products as syrups, cream, cheeses, salad dressings, shampoo, hand-cream, liquid detergents, motor oil, toothpaste, pet food and many other products. It additionally relates to a package which has the capability of dispensing the contained product, e.g., mouthwash, cough syrup, confections, 15 alcoholic beverages, etc., directly into the mouth of the user, and which also includes a reclosure cap member formed as an integral part of the package and which preferably is connected to the package by a tether or hinge member also formed integrally with the package. It will also be seen that the easy opening feature together with the reclosure cap and tether (or hinge) may be formed independently and sealed or 20 adhered to the surface of many packages such as bags, milk containers, pouches, pillow packages (sachets), etc. to make for very efficient low cost dispensing packages or squeeze bags. These squeeze bag type packages could dispense food pastes such as pet food, cremes, grease, yogurt, certain types of dough, cake frosting and could be made of everything from treated, coated paperboard plastic films, foils, laminates or 25 coextrusions of these materials. The easy opening means of this application in its preferred embodiment is comprised of a drum-like protrusion from which a secondary frusto conical protrusion extends to create a tip which is encircled at its base by a fault line. To create the aperture this tip is broken away by applying light lateral finger pressure. In order to protect this breakaway tip during shipment or for reclosing the 30 aperture, a tethered cap is also formed adjacent to the double protrusion. The tether or hinge functions not only to retain the cap, thereby preventing the cap from being lost, but also to hold the cap in place on the tip.

In an alternate aperture forming system the initial drum like protrusion has, instead of a frusto-conical breakaway tip, a fault line pattern defined in its top surface, so designed as to rupture to create an outlet of various required shapes when a puncturing tool/plug is pressed into said fault line pattern. Such puncturing tool/plug may be formed instead of a cap and may be tethered or the cap may be double ended with a cap formation on one end and the puncturing tool/plug formation on the other. It will also be seen that a cap containing a protruding member formed within the cap similar to the style of a flower would perform as a central punch when the cap is pressed over the drum shaped protrusion. It will further be seen that in certain instances where a metal foil liner is required for a flowable product such as an alcoholic drink the drum shaped protrusion may be replaced by a moundlike protrusion with a central fault line pattern. The reason for such a moundlike shape instead of the drum shape is to prevent the stretching of the foil beyond its elastic limit at surface intersections in which case it would rupture during formation. The pattern is able to be punched open by a formed puncturing tool/plug said puncturing tool/plug may be thermoformed and connected integrally by a tether or hinge unit or may be independently made and the tether or hinge may have a formed ring at its free end into which an independently formed puncturing tool plug may be seated.

This invention also relates to a method and apparatus for manufacturing the aforesaid formation and packaging, reliably at high speed, in many cases from fully recyclable material, so as to permit such packages to be produced at low cost and, in many cases, recyclable. Additionally the packages may use less plastic material than most other previously known portion packages leading to source reduction and environmental benefits even when non-recyclable materials are used.

BACKGROUND OF THE INVENTION

Various attempts have been made to provide a dispenser package in which a product may be packaged in the quantity normally required for single or multiple uses, and from which the contained product may be dispensed.

One type of such dispenser packages is a pillow pouch or sachet, typically made of relatively thin plastics and foils or combinations of laminated plastics and foils. These packages are most frequently encountered as containers for catsup, mustard, other condiments, homecare preparations such as hair conditioners, dyes and

cremes, etc. Although this type of package is universally used, it is also universally disliked by the consumer. In order to access the contents, the pouch must be held in one hand while a tearing motion and force are applied by the other hand. Creating the initial tear to break the packages seal is often very difficult, often requiring the assistance of the user's teeth. Moreover, once the initial tear is created, the laminated foil and/or plastic material not only often tears in an uncontrolled fashion, but the holding pressure exerted by one of the user's hands often forces the contents out of the envelope not only before the user is ready to apply the contents, but even before the tearing motion is complete. Opening these packages leads to frayed tempers, broken fingernails, and chipped teeth, as well as other problems. The user must also use both hands to open the container. In the case of invalids, arthritis sufferers and other handicapped people, opening these packages is virtually impossible. Yet another problem associated with these prior packages is the impossibility of efficient reclosure, thereby precluding multiple use of the package, with consequent waste of the unused contents. Further disadvantages include the sachet's inability to function effectively with low viscosity products such as coffee cream, mouthwash or alcoholic beverages, due to the inability of the torn opening to control the direction of flow of such liquids from the package. These packages also are generally totally unrecyclable, and therefore become environmental pollutants. As above-mentioned however, should continued use of these sachets be preferred, then the easy opening feature of this application may be readily and economically adhered to the sachet to make for an easy opening, reclosable, high-barrier package.

Another dispenser package is the peel-top cup used for butter, margarine, syrup, sauces, salad dressing, and other similar products. This type of package requires good eyesight and manual dexterity. Such packages are often used as coffee creamers and have many disadvantages, including difficulty in peeling off the top in order to open, as well as difficulty in pouring, accidental spilling, and the inability to be reclosed so as to preclude more than a single use. Again the inventions described herein can be adhered or integrally formed into these packages to make them easy opening and reclosable. Yet another type of dispenser package is the unsealed corrugated paper package used for salt and/or pepper, which upon bending along an interrupted line cut through the corrugations forms an opening through which the salt

or other material contained in the package may flow. These packages only dispense dry, solid flowables with the assistance of gravity, and cannot be used to contain, no less dispense, "wet" or liquid flowable materials. The package of this invention can contain and readily dispense both liquids and dry granular products.

5 Small, very expensive, metal capped bottles are used for alcoholic drinks and are either poured or consumed directly from the bottle. These bottles may be reclosed, but often are sized for a single drink so they do not have to be reclosed. The instant package can be used for alcoholic beverages at a fraction of the cost of the bottles.

10 Everyone is familiar with the ubiquitous gable top milk carton and everyone is familiar with the varying degrees of difficulty in opening them. These range from fingernail breaking to just plain unopenable without a knife or other tool.

 They never truly reclose and at best are messy and unclean looking. In the U.S. there has been a move toward mounting a screw-on cap combination
15 comprising a threaded nozzle member which is sealed onto one of the slanted gables of the carton and the other is an unattached screw-on cap. This little injection molded duo is costly to make and to install, possibly on the order of 3 to 5 cents and is commonly used on large gable top juice containers in the half gallon size. These are expensive, high profit items selling for about three dollars each and can bear the extra
20 tariff for the screw-on outlets. There are however billions of these gable top units sold annually for milk and cream in varying sizes from half-pints to half gallons. Producers however are reluctant to increase carton cost significantly and the public continues to use difficult to open cartons.

 The instant invention makes available a sealed and tamper evident
25 outlet with an integrally connected cap, both formed in a single, small plastic unit which can be readily sealed or adhesively attached to the gable over a small pre-made hole. It is ultra low cost and may be made of polypropylene, high density polyethylene, PVC. Polyester etc. utilizing material costing small fractions of a cent. It will be seen that the cap serves a double purpose. It enables the outlet to be reclosed
30 after opening and of equal importance, since the cap is in place over the breakaway tip during shipment it protects the tip from being accidentally hit or subjected to any forces which may open the outlet.

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It may be seen that the lower drum-like formation beneath the breakaway tip may be elongated so that when the tip is broken away, an elongated nozzle remains which would allow the flowable substance to be ingested directly from the container or as in the case of motor oil, being poured directly into the engine oil inlet. Another disadvantage currently experienced with dispensing packages is the closing of the outlet opening. Closing the outlet opening of tubes is presently accomplished by means of an injection molded screw-on cap which normally includes a compressible gasketing material. The end of the tube requires a mating thread to match the cap. Both the separately molded gasketed cap and the threaded tube result in increased manufacturing costs. Additionally, the cap, as often as not, is dropped and/or lost while it is being threaded on or off. Furthermore, there has been a growing trend to manufacture such tubes at still greater cost by providing hinged caps with a flat end surface which permits the tube to stand upright. Thus, the cap members currently in use have the disadvantage that they tend to increase the overall cost of manufacture of the dispensing package.

OBJECTS OF THE INVENTION

It is therefore an object of this invention to provide a new and improved means of creating an aperture in a thermoformable plastic material as well as an integrally formed cap and tether where necessary.

A further object is to form independently such aperture creating means with or without a cap and/or tether for adhesion to other forms of previously difficult to open or non-reclosable packaging.

Another object of this invention is to provide new and improved dispenser packages.

Another object of this invention is to provide a new and improved aperture-forming structure for a dispenser package which allows the user to easily and controllably dispense the contents of the package directly to the user's mouth or in a directionally controlled manner, as desired.

Another object of this invention is to provide a new and improved aperture-forming structure for a dispenser package which opens easily and reliably and yet which can be manufactured economically and at high speed.

Another object of this invention is to provide a new and improved

reclosable dispenser package so that the contents thereof may be dispensed in consecutive uses and the outlet opening reclosed between uses.

5 A further object of this invention is to provide a new and improved reclosable package with an attached cap member formed from a single piece of plastic film which cap member may be thereafter placed over the unopened aperture forming means to protect it and/or to reclose the package after opening.

10 Another object of this invention is to provide a new and improved reclosable package and removable cap member which may be formed as an integral unit and where the cap member is attached to an integrally made tether or hinge and remains attached to the package and which may be placed over the unopened aperture forming means to protect it from changes or accidental opening during shipping and handling.

15 Another object of this invention is to provide a new and improved reclosable package and tethered or hinged single sheet or cap member which may be completely formed from a piece of thermoformable material. (film)

Another object of this invention is to provide a new and improved reclosable package and tethered or hinged cap member which may be entirely formed as an integral unit from a thermoformable plastic material that is recyclable.

20 Another object of this invention is to provide a new and improved dispenser package and cap member wherein the top of the cap member has an opening of predetermined shape so that, upon placing the cap over the aperture of the package the contents may be dispensed in such shaped stream.

25 Another object of this invention is to provide a new and improved dispenser package and cap member wherein the cap member includes a utensil device such as tiny protrusions or a flattened surface structure so that the cap member may function as a tool to brush, spread, or otherwise handle the contents dispensed from the package.

30 Another object of the invention is to replace the cap member with a dual function punch/plug member capable of punching through a tough pre-scored formation to create an aperture and to further act as a plug to close said aperture.

A still further object of this invention is to provide a new and improved method of making a dispenser package embodying the aforesaid features.

Another object of this invention is to provide a new and improved method of thermoforming a dispenser package from a recyclable plastic material at high speed and yet provide a finished package which may be easily and reliably opened by the user.

5 Another object of this invention is to provide a new and improved apparatus for forming an aperture-forming structure for a dispenser package.

 Another object of this invention is to provide a new and improved apparatus for forming a nozzle-like aperture structure in a dispenser package so that, upon opening, the contents of the package may be dispensed in a directionally
10 controllable manner.

 Another object of this invention is to provide a new and improved self-centering and self-aligning punch and die apparatus adapted to accurately and reliably form a thermoformable material into a hollow tip-like configuration having a
15 peripherally extending fault line so as to permit the tip to be readily broken away by the user to form an aperture opening through which the contents of the package may be dispensed.

 The foregoing specific objects and advantages of the invention are illustrative of those which can be achieved by the present invention and are not intended to be exhaustive or limiting of the possible advantages which may be
20 realized. Thus, these and other objects and advantages of the invention will be apparent from the description herein or can be learned from practicing the invention, both as embodied herein or as modified in view of any variations which may be apparent to these of ordinary skill in the art, the same being realized and attained by means of the parts, constructions and instrumentations, and combinations thereof, as
25 well as in the steps and processes pointed out in the appended claims. The present invention resides in the novel parts, constructions, arrangements, combinations, steps and processes, and improvements, herein shown and described.

SUMMARY OF THE INVENTION

30 Briefly described this invention is directed to a new reclosable aperture forming means which may be formed with an integrally formed cap member which may be integrally connected to said aperture forming means to create a unit which may be independently formed and adhesively or sealingly attached to a container wall or

surface over a hole in said container wall to create an easy opening, reclosable, when necessary, dispensing package. Said reclosable aperture forming means embodying an integral, hollow protrusion member preferably comprised of two stages, a drum shaped base from which extends a generally cylindrical or frusto-conical tip, said tip member
5 having a fault line encircling it at its juncture with the flat top surface of the first drumlike formation which may be readily broken off to form an opening through which the contents of the package may be dispensed in a directionally controllable stream. After the tip of the protrusion member is broken off by applying light lateral finger pressure, the desired quantity of the contents may thereafter be expelled through
10 the opened nozzle-like outlet by gentle hand squeezing of the package.

In a second embodiment the entire reclosable aperture forming means may be integrally formed into what will become an easy to use reclosable dispensing package. In this second embodiment a generally relatively flexible, compressible pouch or container member is sealably attached to a cover member forming the top or
15 lid of the package. The cover member includes the new reclosable aperture forming means and tethered cap member as described above and similarly used.

In another desirable embodiment the pouch or container member has the integral hollow protrusion and tethered cap member thermoformed into the underside of its relatively stiff rim. The advantage of this version being that the cover
20 member then becomes a relatively thin skinlike member which is very easy to print and less expensive than the formed upper cover member.

The aforesaid cap member which is initially formed with the package as an integral unit is preferably formed along one peripheral edge of either the cover member forming the top or lid of the package relatively closely adjacent to the
25 breakaway protrusion member or on the underside of the rim. A cut line may create a tether member in one version or hinge member may be made either of which permits the cap member to be mechanically removed from its molded position in production and placed over the opened nozzle-like aperture forming means so as to protect the breakaway tip during shipping and handling, while remaining tethered to the package.
30 As also preferably embodied, the aforesaid cap member permits the end user of the package to readily open or reclose the package after each use.

* * * *

In other alternative embodiments of the dispenser package of the present invention:

(i) the breakaway protrusion member forming the aperture in the package may be broken off at the surface of the top or lid of the package, thereby eliminating the nozzle-like outlet configuration in those applications where the contents of the package don't require nozzle formation;

(ii) the cap member may be formed with miniature protrusions to act like a brush, or may have some other desired shape to perform some other desired tool function for use in handling the contents dispensed from the package, such as by brushing or spreading;

(iii) if reclosing the package is not required, the cap member may be open-ended having a predetermined shape such that, upon placing the cap member over the nozzle-like aperture of the package, it can extend the length of the nozzle and the contents may be dispensed in such shaped stream;

(iv) the cap member may be provided with an internal central plug dimensioned to mate with the opening formed in the dispenser package to thereby serve as a plug to further ensure sealing of the opening after removal of the breakaway protrusion member; and

(v) the breakaway protrusion and tethered cap members may be formed in a portion of the cover member which extends beyond one end of the compressible pouch member at a predetermined angle and communicates with the product contained in the pouch by means of a shallow neck or channel, thereby facilitating application of the contents of the package onto a surface, such as, e.g., toothpaste onto a toothbrush or glue onto a break line. Alternatively, the breakaway protrusion member may be formed in the cover member directly over the pouch portion with the cap formed at an adjacent small flat area. This method yields a somewhat larger pouch volume while using the same total amount of material.

It will be understood that the foregoing preferred embodiments of the dispenser package of the present invention may be thermoformed from a wide variety of plastic materials, including, e.g., PP (polypropylene) Barex, HDPE (high density polyethylene), HIPS (high impact polystyrene) and foamed HIPS, as well as various laminations and/or coextrusions of the aforesaid materials and many other plastic

materials, including, e.g., PP/EVOH (ethylene vinyl alcohol)/PP; Barex/PP; Barex/EVOH/PP; PET (polyethylene tetrafluoride)/LLDPE (linear low density polyethylene); PET/EVOH/LLDPE; PVC (polyvinylchloride)/LLDPE; NY (nylon)/LLDPE; and NY/EVOH/LLDPE.

5 It also will be understood that the foregoing preferred embodiments of the dispenser packages of the present invention may be manufactured in a wide variety of sizes, as desired, although the preferred size range for hand held units is from about 2 ml capacity to about 4 fluid ounce capacity. Similarly, the aforesaid package may be manufactured in a wide range of dimensions. A typical size for a package containing
10 30 ml or 1 fluid ounce of material is on the order of about 1 inch deep by about 1 inch wide by about 3 to 4 inches long, which fits comfortably in the palm of the hand of most users. Furthermore, the independent formations of aperture forming means and the tethered or hinged caps may be applied to a very wide range of packaged from single use sizes to half gallons.

15 Briefly described, as preferably embodied, the apparatus of the present invention forming the preferred aperture-forming protrusion member in the cover member of the dispenser package includes a two-stage punch member which advances to engage and clamp a thermoformable material against a self-centering and self-aligning hollow anvil member. The first punch member advances to initially form a
20 hollow, drum-shaped protrusion in a specific pre-heated area of the thermoformable material. Thereafter, a second punch member preferably located within, and moveable relative to, the first punch member continues to advance forward. The second punch member includes a first generally frusto-conically shaped surface adapted to form a substantially cylindrical or frusto-conically shaped hollow tip member extending from
25 the drum-like protrusion formed by the first punch member. At the moment formation of the hollow tip member is completed, the forward advancement of the second punch brings a second shallow conical surface into cooperating engagement with the peripheral edge or rim defining the hollow portion of the anvil member to thereby compress the wall of the formed hollow tip about a peripheral portion thereof to create
30 a weakened fault line in the hollow tip protrusion member. As here preferably embodied, the aforesaid punch and anvil members create a fault line at the base of the aforesaid hollow tip protrusion member which extends continuously about the

periphery thereof.

In an alternative embodiment of the apparatus of the present invention, the heated sheet of thermoformable material is clamped against the anvil member and a single stage punch member having a generally frusto-conically shaped forward end portion is thereafter advanced to form the aforesaid hollow, substantially cylindrical or frusto-conically shaped tip member. At the moment formation of the hollow tip member is completed, the rim of the anvil member compresses the wall of the hollow tip member about the periphery thereof to create a weakened fault line. It will be seen that the heated thermoformable film (material) may be clamped against a relatively thin plate spaced away from the anvil which contains an accurately aligned hole centered on the aperture of the anvil member. In this embodiment, between the punch and anvil the film will be formed into a conical member as the punch is advanced through the plate and said conical member will then be further formed until it contacts the peripheral edge or rim at the opening of the aperture in the anvil. This alternate apparatus creates a fault line banding or girdling the formed conically-shaped tip member at a predetermined point between its base and its apex.

It will be appreciated by those skilled in the art that the foregoing various brief descriptions and the following detailed description are exemplary and explanatory of the present invention, but are not intended to be restrictive thereof or limiting of the advantages which can be achieved by the invention or various combinations thereof. The accompanying drawings, referred to herein and constituting in part hereof, illustrate preferred embodiments of the invention and, together with the detailed description, serve to explain the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation view of a dispenser package constructed in accordance with the present invention with an integrally formed cap member;

FIG. 2 is a top plan view of the dispenser package of Figure 1;

FIG. 2a is a perspective view of a dispenser package constructed in accordance with the present invention with an integrally formed cap member on the underside of the containment members rim and their skin like unformed cover member;

FIG. 3 is an end view of the dispenser package of Figure 1;

FIG. 3a is an end view of the dispenser package of Figure 2a showing an unformed very thin flexible cover member;

FIG. 4 is a side view in elevation, partly sectional, of an apparatus constructed in accordance with the present invention for forming the breakaway tip and nozzle protrusion members in a heated sheet of thermoplastic material;

FIG. 5 is an enlarged sectional view, partly in elevation, of the first and second punch members and the self-aligning hollow anvil member illustrated in FIG. 4, this view illustrating formation of the first protrusion member in the thermoplastic sheet material;

FIG. 6 is an enlarged view similar to FIG. 5, illustrating formation of the second protrusion member in the thermoplastic sheet material;

FIG. 7 is an enlarged view of FIG. 6, illustrating formation of the peripherally extending weakened fault line at the base of the second protrusion member;

FIG. 7a an enlarged side plan view of first and second protrusion members according to one embodiment of the present invention;

FIG. 7b is an enlarged side plan view of first and second protrusion members according to one embodiment of the present invention;

FIG. 8 is an isometric view of the dispensing package of Figure 1;

FIG. 9 is an enlarged isometric view of the dispensing package of Figure 8, illustrating the cap member removed from its molded position and placed over the breakaway tip protrusion member;

FIG. 10 is a schematic illustration showing the use of a hollow punch member for forming a central sealing plug member in the cap member illustrated in the preceding drawings;

FIG. 11 is an isometric view of a cap member formed with a central plug from the apparatus of Figure 10;

FIG. 12 is an enlarged cross-sectional view, partly in elevation, illustrating an alternative embodiment of the punch and anvil apparatus of the present invention, wherein a single punch member forms a hollow frusto-conical protrusion in the surface of the cover member for a dispenser package and the anvil member compresses the wall of the tip to form a peripherally extending fault line on the surface

of the protruding tip;

FIG. 12a is an enlarged cross-sectional view, partly in elevation, illustrating an alternative embodiment of the punch and anvil apparatus of the present invention, wherein a single punch member forms a hollow frusto-conical protrusion having a right-cylindrical base in the surface of the cover member for a dispenser package and the anvil member compresses the wall of the tip to form a peripherally extending fault line on the surface of the protruding tip;

FIG. 12b is an enlarged cross-sectional view, partly in elevation, illustrating an alternative embodiment of the punch and anvil apparatus of the present invention, wherein a single punch member having a spherical tip forms a hollow mound protrusion in the surface of the cover member for a dispenser package and the anvil member compresses the wall of the tip to form a peripherally extending fault line on the surface of the mound;

FIG. 13 is a schematic elevation view of the breakaway tip formed by the punch and anvil members illustrated in FIG. 12;

FIG. 13a is a schematic elevation view of the breakaway tip formed by the punch and anvil members illustrated in FIG. 12a;

FIG. 14 is a top plan view of another embodiment of a dispenser package constructed in accordance with the present invention, wherein the breakaway tip and cap member are formed in a lateral extension of the cover member and the breakaway tip member communicates with the containment pouch through a shallow channel member;

FIG. 15 is a side view of the embodiment illustrated in FIG. 14;

FIG. 16 is an end view of the embodiment illustrated in FIG. 14;

FIG. 17 is a side view of the embodiment of the invention illustrated in FIG. 14, wherein the lateral extension of the cover member also extends angularly downwardly;

FIG. 18 is a schematic view of an alternate embodiment of the cap member, formed with bristles or nubs on its outer surface;

FIG. 19 is a schematic view of another alternate embodiment of the cap member, formed with a flattened spreader tool utensil on its outer surface;

FIGS. 20a-d are partial end views of still other alternate embodiments

of the cap member of the present invention, each view illustrating an open-ended cap member;

FIG. 21a is a top plan view of a reclosable outlet aperture forming structure which can be applied to various forms of containers in accordance with an alternate embodiment of the present invention;

FIG. 21b is a side view of the reclosable outlet aperture forming structure shown in FIG. 21a;

FIG. 22a is a perspective view of the reclosable outlet aperture forming structure of FIGs. 21a-b, as applied to a milk carton, in which the cap is placed over the outlet;

FIG. 22b is a perspective view of the reclosable outlet aperture forming structure of FIGs. 21a-b, as applied to a milk carton, in which the cap is removed from the outlet so as to allow removal of the breakaway outlet tip;

FIG. 22c is a perspective view of the reclosable outlet aperture forming structure of FIGs. 21a-b, as applied to a milk carton, in which the breakaway tip is removed from the outlet to form an opening therethrough;

FIG. 22d is a perspective view of the milk carton of Figures 22a-c, in which the breakaway tip is removed from the outlet to form an opening through which milk is being poured;

FIG. 23 is a side view of a low profile breakaway tip in accordance with another embodiment of the present invention;

FIG. 23a is a side view of a low profile breakaway tip in accordance with another embodiment of the present invention;

FIG. 24 is a top view of the low profile breakaway tip of FIG. 23;

FIG. 24a is a top view of the low profile breakaway tip of FIG. 23a;

FIG. 25 is a perspective view of the low profile breakaway tip of FIG. 23 with the removed breakaway tip shown in phantom;

FIG. 26 is a side view of a cap for use with the low profile breakaway tip of FIG. 23;

FIG. 27 is a side view of a another embodiment of the present invention which utilizes a twist-lock or twist-threading arrangement to secure the cap to the base formation;

FIG. 28a is a perspective view of another embodiment of the present invention in which a tethered plug is used to open and close a pre-scored surface;

FIG. 28b is a perspective view of the embodiment of FIG. 29a in which the pre-scored surface has been opened;

5 FIG. 28c is a perspective view of the embodiment of FIG. 28a in which the plug has been placed in the outlet hole, thereby opening the hole along the pre-scored surface and/or plugging the hole;

FIGs. 29a-d are top views of the outlet of the embodiment of FIG. 28a depicting various types of scored surfaces formed in the outlet; and

10 FIGs. 30a-d are side views of the scored surfaces shown in FIGs. 29a-d, in which each of the scored surfaces has been penetrated to create an opening therethrough and a flap descending from the surface;

FIG. 31 is a partially elevated side view of an outlet forming structure according to an alternative embodiment of the present invention, having a punch/plug and a scored mount, as applied to a milk carton;

15 FIG. 32 is a top plan view of the outlet forming structure of Figure 31;

FIG. 33 is a side plan view of the outlet forming structure of Figures 31 and 32;

20 FIG. 34 is an enlarged elevated view of the outlet forming structure of Figures 31-33;

FIG. 35 is an enlarged side plan view of the outlet forming structure of Figures 31-34 showing the mound as punctured by the punch/plug;

FIG. 36 is an enlarged side plan view of the mound of Figures 31-35;

25 FIG. 37 is a side plan view of an alternative embodiment of the present invention in which an outlet forming structure, having a breakaway tip and cap, is applied to a foil package;

FIG. 38 is an enlarged side elevational view of the outlet forming structure of Figure 37;

30 FIG. 39 is an elevated plan view of an alternative embodiment of the present invention as applied to a foil package;

FIG. 37a is a side plan view of an alternative embodiment of the present invention in which an outlet forming structure is applied to a foil package;

FIG. 38a is a front plan view of the outlet forming structure of Figure 37a;

FIG. 39a is an elevated plan view of the outlet forming structure of Figures 37a and 38a;

5 FIG. 40 is a partial elevational view of an outlet forming structure according to another alternative embodiment of the present invention, having a snap-in auxiliary punch/plug/cap and protrusion member, that is manufactured by a pick-and-place method;

10 FIG. 40a is an enlarged side plan view of the outlet forming structure of Figure 40 showing the punch/plug/cap puncturing the protrusion member;

FIG. 41 is a top plan view of an alternative embodiment, wherein the outlet forming structures are formed from a single thermoplastic web in a mating arrangement;

15 FIG. 42 is a side plan view of an alternative embodiment of the present invention in which the reclosable container is provided with a scored protrusion and a dual purpose tethered punch/cap;

FIG. 43 is a top plan view of the reclosable container of Figure 42;

FIG. 44 is a top plan view of the reclosable container of Figures 42 and 43, wherein the tethered punch/cap is securely fastened over the scored protrusion;

20 FIG. 45 is an elevated plan view of an outlet forming structure according to one embodiment of the present invention;

FIGS. 46a-c are side plan views of a container for use with an outlet forming structure according to the present invention;

25 FIG. 47 is an elevated plan view of the container of Figures 46a-c with the outlet forming structure of Figure 45 mounted thereon;

FIG. 48 is a top plan view of a container according to an embodiment of the present invention;

FIG. 49 is a side plan view of the container of Figure 49;

30 FIG. 50 is a side plan view of the container of Figures 48 and 49 in a closed position;

FIG. 51 is a side perspective view of the container of Figures 48-50;

FIG. 52 is a side elevational view of a container according to an

embodiment of the present invention;

FIG. 53 is an enlarged side plan view of the outlet forming structure of Figure 52; and

5 FIG. 54 is a top plan view of a section of a web of thermoformable material having a series of outlet forming structures formed therein.

FIG. 55a is a perspective view of a tetrahedral tube with a breakaway tip portion and a tethered cap.

FIG. 55b is a perspective view of a tetrahedral tube with a tethered cap in place over a breakaway tip portion.

10 FIG. 55c is a perspective view of a tetrahedral tube with a tethered cap dispensing product from a breakaway tip portion.

FIG. 56a is a perspective view of a tetrahedral tube having a hinged fin seal containing a cap member, where the cap member is in the wide open position.

15 FIG. 56b is a perspective view of a tetrahedral tube having a hinged fin seal containing a cap member, where the cap member is in the midway open position.

FIG. 56c is a perspective view of a tetrahedral tube having a hinged fin seal containing a cap member, where the cap member is in the fully closed position.

20 FIG. 57a is a perspective view of a tetrahedral tube having a hinged fin seal containing a cap member, showing the portion of the breakaway tip that is broken off to allow product to be dispensed.

FIG. 57b is a perspective view of a tetrahedral tube having a hinged fin seal containing a cap member, where the cap member is in the fully closed position.

25 FIG. 57c is a perspective view of a tetrahedral tube having a hinged fin seal containing a cap member, showing product being dispensed from the breakaway tip portion.

FIG. 58a is a perspective view of a tetrahedral tube with an articulated or multiple hinged flap in the fully closed position.

FIG. 58b is a perspective view of a tetrahedral tube with an articulated or multiple hinged flap in the wide open position.

30 FIG. 58c is a perspective view of a tetrahedral tube with an articulated or multiple hinged flap dispensing product from the breakaway tip portion.

FIG. 58d-58g are views of adjustment heat seals which bring a

breakaway tip formation to a correct angle.

FIG. 58h-58i are views of a breakaway tip formation formed though two layers of film for strength and for providing an extra barrier.

5 FIG. 59a is a side view of a tetrahedral tube with an articulated or multiple hinged flap in the midway open position.

FIG. 59b is a perspective view of a tetrahedral tube with an articulated or multiple hinged flap in the fully closed position.

FIG. 59c is an enlarged perspective view of a tetrahedral tube with an articulated or multiple hinged flap in the fully closed position.

10 FIG. 59d is an end view of a tetrahedral tube with an articulated or multiple hinged flap in the fully open position.

FIGS. 60a-60c are perspective views of an independent easy opening breakaway tip with hinged cap for adhesion to other packaging, where the hinged cap is in the wide open, midway open, and fully closed positions respectively.

15 FIGS. 61a is a perspective view of a gable top milk container fitted with the independent easy opening tip with hinged cap of FIGS. 60a-60c, where the hinged cap is wide open and the breakaway tip is being removed.

20 FIG. 61b is a perspective view of a gable top milk container fitted with the independent easy opening tip with hinged cap of FIGS. 60a-60c, where the hinged cap is wide open and the breakaway tip is intact.

FIG. 61c is a perspective view of a gable top milk container fitted with the independent easy opening tip with hinged cap of FIGS. 60a-60c, where the hinged cap is in the fully closed position.

25 FIG. 62a is an enlarged top view of a tetrahedral tube having a fault line with at least one curved section located just beneath the fin seal and an arched aperture cut in the wall of the tube by bending the curved section.

FIG. 62b is a top view of a tetrahedral tube having a fault line with at least one curved section sealed to the tube wall beneath surface and an arched aperture cut in the wall of the tube by bending the curved section.

30 FIGS. 62c-62d are top views of members having curvilinear fault lines of two different shapes.

FIG. 62e is a side view of the tetrahedral tube of Figs. 62a-62b,

showing the manner in which the curved section is bent to create the arched aperture.

FIG. 62f is a side view of the tetrahedral tube of Figs. 62a, 62b and 62e dispensing product through the arched aperture.

5 FIG. 63 is a cross-sectional side view of a tetrahedral tube with an angled breakaway tip formation and hinged flap containing a cap member.

FIG. 64a is a side view of a cap with a flat portion to grip a breakaway tip.

FIG. 64b is a cross-sectional top view of a cap with a flat portion to grip a breakaway tip.

10 FIG. 65 is a perspective view of a breakaway tip portion with a hinged flap containing a cap member where adhesive is applied to the flap to hold the flap down.

FIG. 66a is a top view of a tetrahedral tube with openings for attachment of cap member and opening or outlet feature.

15 FIGS. 66b-d are enlarged side views of a tetrahedral tube with cap member and opening or outlet feature attached through openings in the hinge flap and the tube face respectively.

FIGS. 67a-g are views of the steps of the manufacturing process of the flat-style and tetrahedral-style tubes of the present invention.

20 FIG. 68 is a sequential fabrication diagram for the flat-style tube of the present invention.

FIG. 69 is a sequential fabrication diagram for the tetrahedral-style tube of the present invention.

25 FIG. 70 is a perspective view of a flat-style tube with a splayed base in accordance with another embodiment of the present invention.

FIGS. 71-72 are side and front views, respectively, of a tetrahedral-style tube with splayed base in accordance with another embodiment of the present invention.

30 FIG. 73 is a perspective view of a free-standing tube having a hollow insert in accordance with another embodiment of the present invention.

FIGS. 74-75 are, respectively, side and front views of the free standing tube of FIG. 73.

FIG. 76 is a bottom view along lines 76-76 of the free standing tube of FIG. 75.

FIG. 77 is a perspective view of a seamless tube in accordance with another embodiment of the present invention.

5 FIG. 78 is a seamless tube with end seals and aperture forming means in accordance with another embodiment of the present invention.

FIG. 79 is a seamless tube with a cap and hinged flap in accordance with another embodiment of the present invention.

10 FIGS. 80-81 are regular and tetrahedral-style tubes, using the seamless tube configuration.

FIG. 82 is a free standing seamless tube in accordance with another embodiment of the present invention.

FIG. 83 is a perspective view of the hinged cap with a washboard pattern of grooves in accordance with one embodiment of the present invention.

15 FIG. 84 is a side view of the hinged cap of Figure 83.

DETAILED DESCRIPTION OF VARIOUS PREFERRED EMBODIMENTS

DEVELOPMENT

5 The idea of making a seamed tubular member of plastic film was first conceived with a breakaway tip formed into its wall close to one end. A half inch double thickness flat seal at the end of the tube adjacent to the breakaway tip was then made. An arrangement was made in which the cap was offset to one side of the flat seal so that a maximum length tether (see fig. 55a) could be achieved. The seal was cut in the required manner to create the tether, which worked satisfactorily. The tube
10 was then filled with toothpaste and sealed, the open end having both end seals parallel and in the same plane. The package was rather flat but functioned satisfactorily. The flat configuration has merit as a sampling package because it could be easily mailed in an envelope and it could be made on a modified standard tubular pouch machine. It was then decided to rotate the second end seal ninety degrees to create a tetrahedron
15 with a three dimensional appearance. The resulting design was remarkably good. Such a design allowed for the shortening of the overall length saving material over the flat tube for the same quantity of product. In manufacturing this design, a cap was accidentally centered on the seal instead of offset. On seeing it, it was realized that if the seal could bend with the cap over the breakaway tip it would slip over the cap if
20 correctly aligned. It actually did fold over but at the angle the cap approached the tip and couldn't slip over it. An articulated hinge was then conceived to address the problem. At present, a hot lined die is pressed into the film and creates a number of fine parallel lines pressed into the film which makes for easy bending and has the flexibility required to slip over the tip.

25

DETAILED DESCRIPTION

Referring now more particularly to FIGS. 1-4 and 9 of the accompanying drawings, there is illustrated a dispensing package indicated generally
30 at 10 according to the present invention. The package 10 can be used for single or multiple uses and can be reclosed for further use.

As illustrated in FIGS. 1 and 4, the package 10 includes a cover

member 11 formed from a flexible but relatively stiff generally flat sheet 12 of a thermoformable plastic material most suitable to the product contained and the protection that the contained product requires.

5 Materials such as high-impact polystyrene (HIPS), high density polyethylene (HDPE) polyester, HDPE/EVOH (high density polyethylene/ethylene vinyl alcohol), Barex, polypropylene, etc. may be used. HIPS, HDPE, and HPDE/EVOH are each low cost and can be recycled. HDPE/EVOH creates a superior O₂ barrier.

10 As will be understood by those skilled in the art, whereas plastics of similar material may be heat-sealed or bonded together, heat sealing different plastics together requires an adhesive layer. Preferably, linear low density polyethylene (LLDPE) is used as such a layer. Thus, multi-layered plastics formed by coextrusion may be sealed together to form sheet 12 having sealant/barrier 14 of the present invention.

15 Also suitably bonded to one face of bonded sheet 12, 14 is a flexible sheet 18 forming at least one pouch chamber 22 adjacent one face of the relatively stiff sheet 12 or bonded sheet 12, 14 for containing a preferably flowable substance, e.g. a dry powdered or granulated material or a liquid material of any suitable viscosity capable of flowing under light to moderate hand pressure.

20 Advantageously, and as here preferably embodied, the layer of a suitable sealant/vapor impervious barrier material 14 is suitably integrally bonded to sheet 12 on the inner surface 16 which faces flexible sheet 18. Flexible sheet 18, advantageously formed by conventional means, such as vacuum forming, pressure forming, mechanical forming or combinations thereof, is likewise suitably integrally
25 bonded to either inner surface 16 or sealant/barrier 14 of sheet 12, as the case may be.

The bonds between substantially flat relatively stiff sheet 12, sealant/barrier material 14 and flexible sheet 18 also may be formed by conventional means known to persons of ordinary skill in the packaging art, such as welding, heat sealing, or adhesive or cohesive bonding. It will be understood that the particular
30 bonding method selected depends upon the particular properties of the materials used and the flowable substance(s) to be contained in the package.

Advantageously, and as preferably embodied, sheet 12 is preferably

made of polypropylene (PP), Barex, high impact polystyrene (HIPS) or high-density polyethylene (HDPE), but when combined with barrier 14 may be made of polystyrene, polyester, EVOH (ethylene vinyl alcohol), polyvinyl chloride (PVC), polyethylene tetrafluoride (PET) or nylon, or a copolymer thereof, and barrier 14 is made of a suitable sealant/vapor impervious barrier material, preferably comprising saran and foil laminate, or comprising a laminate of foil and vinyl, or foil alone, depending on the nature of the contents to be contained.

A particularly tough high barrier construction comprises saran laminated on each side with polyethylene (sold by Dow Chemical Co. under the name "Saranex") as barrier sheet 14, in turn laminated onto polystyrene or polyester, forming the flexible but relatively stiff sheet 12. The thickness of sheet 12 varies according to factors, such as the properties of the materials used, the flowable substance contained, and the intended usage. A generally utilized range is 4-12 mils (0.004-0.012"). As previously noted, sheet 12 preferably is somewhat flexible, although more rigid than the material 18 forming pouch 22, and preferably is stiffened by raised portion 11a formed in cover 11 in the preferred construction of package 10.

It will be understood by those of ordinary skill in the art that the bonds formed between materials 12, 14 and 18 can be obtained by the conventional means previously described, again depending on the nature of the flowable substance being contained.

It will be seen from the foregoing that the structure of FIGS. 1 and 2 forms an enclosed pouch or chamber 22 between the flexible sheet 18 and the relatively stiff member 12, 14 in which a preferably flowable substance is contained and from which the contained substance is dispensed.

In accordance with the present invention as preferably embodied, the relatively stiff generally flat sheet 12 forming cover 11 includes an aperture-forming protrusion structure 30 which includes a neck member 32 and a breakaway tip member 34 so that, upon removal of tip 34, neck 32 forms a nozzle-like aperture in package 10 through which the contents may be dispensed in a directionally controllable manner.

Neck and tip protrusions 32, 34 preferably are substantially hollow, substantially cylindrical and tip 34 preferably is substantially cylindrical or frusto-conical. In the preferred embodiment as shown in the plan view of Figure 3, the

aperture-forming protrusion structure 30 is located in cover 11 directly over pouch 22 so that, when opened, nozzle aperture 32 communicates directly with the contents of pouch 22.

5 In accordance with the present invention, as preferably embodied, dispenser package 10 includes a cap member 110 formed as an integral part of cover 11. Advantageously, cap member 110 is removable from cover 11 along a line.

10 It will be seen that the cap 110 protects the breakaway tip structure 30 from inadvertently breaking off during shipping and handling prior to use, as well as providing a means to reclose the package after opening, i.e., after the protrusion tip member 34 is broken off. Thus, cap 110 protects the remaining contents of the package after each use, permitting multiple uses. The advantage of the tethered embodiment of the invention is that it costs practically nothing, acts as a side pressure spring to maintain the cap on the neck 32 at the opening, acts as a grasping member to assist removal of the cap for each subsequent use, and prevents loss of the cap before
15 the contents of the package have been fully dispensed and the package is ready to be disposed of. Further details of the cap are explained below.

In practically all cases, however, it is believed preferable to provide the two-stage breakaway tip configuration since the first projecting cylindrical formation 32 acts as a nozzle yielding directionally controllable product dispensation, after the
20 tip, i.e., second protrusion 34, is broken off. Low and medium viscosity flowable products tend to squirt "side-ways" or spurt in non-controllable directions, when passing through an aperture formed in the plane of the cover member. Furthermore, elevating the breakaway tip from the surface of the cover member greatly enhances its ease of use with no practical increase in manufacturing cost.

25 In use, as here preferably embodied, package 10 preferably is positioned so that pouch or chamber 22 rests in the palm of the hand with the thumb resting on the cover 11. The thumb or finger of the holding hand, or the user's other hand, if desired, may then be used to apply a light finger pressure against the side of protrusion tip 34, i.e., the breakaway tip, thereby causing tip 34 to break off, leaving
30 an open neck or nozzle-like aperture 32.

Once tip 34 is removed and the package thereby opened, the contents of the package 10 may be expelled. This method of use depends on the type of substance

contained in the package and where the user would like to place the contents. For example, if the package contains toothpaste, the open nozzle 32 preferably would be placed over a tooth brush, whereupon gentle squeezing of the package 10 will force the toothpaste onto the toothbrush. If the contents of the package are intended to be placed directly into the user's mouth, or the mouth of a patient, such as for oral medicine or mouthwash, the open nozzle 32 then may be placed directly into the mouth and a portion, or all, of the contents may then be directed into the mouth by squeezing the package. When the desired quantity of the contents of the package has been expelled, if some contents remain, package 10 may then be reclosed for future use by placing cap 110 over the open nozzle 32.

As previously mentioned, as here preferably embodied, package 10 further includes a cap 110. While cap 110 may be formed separately from the other elements of package 10, in the preferred embodiment cap 110 is integrally formed with and is at least partially detachable from the relatively stiff sheet 12 forming cover 11, as shown in FIGS. 1-3, 9-10, 15-18, 22-23d, 29a-c, 32-35, 38-40, and 42-47, for example.

As shown in Figs. 1-3 and 8-9, cap 110 preferably is located at one corner in cover 11 so as to overhang pouch 22. A cut line 114 allows cap 110 to be easily removed from cover 11. Advantageously, as best seen in Fig. 10, cut line 114 extends only partially along the edge of cover 11 so as to provide a tether 130 to maintain cap 110 attached to package 10 even after the cap is placed over either the aperture-forming structure 30 or over the open nozzle 32.

Cap 110 typically is unthreaded and is dimensioned to fit smoothly, yet securely, over the necked protrusion 32, which preferably also is smooth and unthreaded, both before and after removal of tip 34. Cap 110 has a base 126 which lies flat against the top of cover 11. Tether 130 has several advantages. First, it has been discovered that the tether 130 acts as a spring pressing the cap against the sidewall of the necked protrusion 32, thereby assisting to hold cap 110 in place when it is placed over the necked protrusion 32. Additionally, tether 130 provides the added benefit of preventing the cap 110 from becoming lost and allows the user to grip the tether 130 to assist in removal of the cap 130 from the aperture-forming structure 30 or from open nozzle 32.

Cap 110 of the present invention can be designed in several different embodiments. For example, in the embodiment shown in Figures 10 and 11, the cap can be formed from a hollow punch member 120 that forces the material into a hollow female member 122 with a central protrusion 124 to form a cap with a central plug 126.

An alternative to the embodiment shown in Figs. 1-4 is shown in Figs. 2a and 3a. As shown, the container 10a has generally the same configuration as container 10 depicted in Figs. 1-3 is made of the same materials. Specifically, pouch 22a is formed between a flexible sheet 18a and the very thin skin like sheet 12a, 14a, in which a flowable substance is contained. Unlike the previous embodiment, the aperture-forming protrusion structure 30a is formed on the underside of the flat sheet 18. Similarly, the cap 110a is formed on the underside of the sheet 18. With such an arrangement, not only are the neck and tip protrusions 32a, 34a of the protrusion structure 30a protected from accidental rupture, but also the container 10a is provided with a low cost flexible cover. In order for the protrusion structure 30a to be in fluid communication with the contents of the pouch 22a, the pouch 22a is provided with a channel 11b which communicates with the protrusion structure.

It will be understood that the aperture-forming protrusion structure 30 may be made by a variety of methods and apparatus. In accordance with the present invention, however, as preferably embodied, a web of thermoformable material to be formed into cover 11 is first heated to a sufficient forming temperature. The web is then formed into the hollow cylindrical protrusion 32 with a closed end. The closed end portion of the cylinder 32 is then further deformed in its central section to create the tip 34. At the moment tip 34 is completely formed, the intersection of the base of tip 34 and cylinder 32 is compressed, reducing its thickness, to thereby create a fault line extending about the periphery of the base of tip 34.

Also in accordance with the present invention, as here preferably embodied, aperture-forming protrusion 30 is formed by means of a self-centering and self-aligning male and female punch and die apparatus, indicated generally at 40, as shown in Figs. 4-7.

Apparatus 40 includes feed rollers 42 or other means to advance the web or film "F" of thermoformable material into a heating station 44 where a heater

block 46 advances against the film to press the sheet against a stationary heater block 48, which is temperature controlled by a thermocouple 50 and supplied with necessary power at connection 51. An air cylinder 52 provides the driving force to move the heater block 46 by means of shaft 54. The heater block 46 includes two heaters energized by an appropriate power source 58.

A two-stage punch member 60 includes a first male punch 62 formed as a generally cylindrical hollow punch having a substantially flat end surface 64 at its operative end. When the first punch member is advanced, the end surface 64 engages and deforms the heated sheet of thermoformable, preferably plastic, material F, compressing the plastic against a similarly shaped, oppositely mounted, generally cylindrical hollow anvil member 66 movable in a bore 68 of a support 70. The anvil 66 has an end face 71. The first punch 62 has a clearance fit with the bore 68 so it can be moved therein to confront the end face of the anvil 66. Anvil 66 has an aperture bore 67 formed as part of its hollow portion.

Anvil 66 is part of a spring-loaded rocker member 72, preferably supported by a ball-shaped member 74, or other similarly shaped curved rocker device, in a larger base opening 75 so as to be both resilient and self-centering and self-aligning with punch member 60. Although rocker 74 is preferably curved or ball-shaped, a relatively flat surface in spring-mounted engagement with the base of adjustable mechanism 89 also serves to self-center the aperture opening 67 of anvil member 66 with respect to frusto-conical surface 84 and bevelled surface 83 of second punch 80, more fully described hereinafter. The peripheral edge or rim of aperture 67 in anvil 66 is smaller than the bore of punch 62 to create an internal shoulder 76 when the opposing substantially flat end surfaces 64, 71 of the hollow cylindrical punch member 62 and the anvil member 66 are brought together. The anvil and first punch are preferably made of hardened steel.

In use, at the end of the first stage of the formation of the aperture-forming protrusion 30, shown in Figure 5, the plastic web F is formed into a projecting, closed end, hollow generally cylindrical drum-like shape, with the plastic web stretched across the end of the first generally cylindrical hollow punch, and clamped between the opposed facing end surfaces 64, 71 of the punch and anvil members.

A second punch member 80 is mounted for travel within a hollow bore 81 and beyond the end face 64 of the first punch member 62. The second punch member 80 includes a shaft 82 whose operative end surface includes a shallow bevel 83, advantageously on the order of 45°, terminating into a conically-shaped portion 84 with a flat end face 85 forming a frusto-conically shaped tip, indicated generally at 86. The second punch member and its bevel 83 advances into controlled engagement with the internal peripheral edge of the shoulder 76 formed at the opposed end surfaces 64, 71 of the first punch 62 and anvil 66.

In one aspect of the present invention, as preferably embodied, the second punch member 80 can be constructed in multiple parts. For example, each of the frusto-conical and beveled portions 84, 83 may be formed separately and removably attached to the leading end surface of the shaft 82, such as by threaded connections. Alternatively, shaft 82 and tip portions 83, 84 may be formed as an integral unit. The second punch member is driven by air cylinder 87.

It will be understood from the foregoing that the full length of the frusto-conical end 86 of punch 80 continues to travel past the formed internal shoulder 76 and into the anvil aperture 67 until such time as bevel surface 83 is brought into accurately controlled cooperating engagement with the internal peripheral edge of the internal shoulder 76 formed by the opposed end surfaces 64, 71 of the first punch 62 and the anvil 66. Advancement of punch surface 83 against shoulder 76 is accurately controlled by micrometer punch adjustment mechanism 88 and anvil adjustable stop mechanism 89.

The still-heated closed end of the initially formed hollow cylinder 32, i.e., the first drum-like protrusion of the aperture-forming structure 30 is, in a second stage, further formed into a substantially cylindrical or frusto-conically shaped tip 34, i.e., the second protrusion of the aperture-forming structure 30, by the advancing second punch member until the shallow bevelled surface 83 of punch 80 engages the plastic sheet. At that time, the second punch surface 83 controllably compresses, cools and sets the plastic web F against the internal peripherally extending edge formed at shoulder 76 of the anvil to reduce the thickness, and thereby weaken, the wall of the plastic at the locus of the peripheral edge so as to form a narrow, peripherally extending indentation 100, known as a rupture or fault line, at the base of tip

protrusion 34. It will be seen that fault line 100 permits the tip protrusion 34 to be readily broken away by means of only light lateral pressure to thereby form a nozzle-like outlet opening at neck protrusion 32.

5 It should be noted that changes in the dimensions of the beveled end 86 and the anvil 66 are within the scope of the present invention. For example, it is often desirable to produce a fine stream of the contents of a container, such as motor oil. Consequently, the opening formed by the base of the tip protrusion 34 must be relatively small, such as shown in Fig. 8a. To form such a aperture-forming protrusion structure 30, the end 86 is elongated, and the beveled surface 83 is positioned closer to
10 the distal end 85. Furthermore, the anvil 66 is provided with a relatively narrow opening. Consequently, as shown in Fig. 7a, the fault line 100 and the breakaway tip 34a are smaller. Alternatively, the entire punch 82 and, therefore, protrusion structure 30 is made narrower.

In other applications, where the contents of a container are large
15 particles, such as cat food, the opening must be relatively large, such as shown in Fig. 7b. To achieve a larger opening, the entire punch 82 and, therefore, protrusion structure 30 are made wider. Alternatively, the fault line 100 and the break away tip 34 are made larger.

In an alternate embodiment illustrated in Figures 12 and 13, a single
20 punch 90 with a truncated end 92 can be used. The single punch 90 includes a bevelled surface 94 which engages the film or web F of thermoplastic material to form the generally frusto-conical hollow tip protrusion 34. As here embodied, thermoplastic web F is first clamped between shoulder plate 96 and face 97 of an outer punch member similar to punch 62. Thereafter, punch 90 advances, whereupon end
25 94 forms web F into frusto-conical tip 34, as shown as Fig. 13. As alternatively embodied, however, as best seen in Fig. 12, upon completion of the formation of tip 34, the peripheral edge 76a of anvil member 70 engages and compresses the outer surface of the frusto-conical wall of tip 34 to create a peripherally extending fault line 100a along the projecting surface of tip 34 between its base and apex.

30 In yet another alternative embodiment illustrated in Figs. 12a and 13a, a single punch 91 with a beveled, truncated end 93 can be used to form the generally frusto-conical hollow tip protrusion 31. The single punch 91 engages the film or web

F of thermoplastic material with the beveled surface 93. As with the embodiment shown in Figs. 13 and 14, the thermoplastic web F is first clamped between stop plate 95 and clamp means 98 of an outer punch member. Thereafter, punch 91 advances, whereupon end 93 forms web F into the frusto-conical tip 31. As best shown in Fig. 13a, contact of the peripheral edge 77 of angle member 71 compresses the outer surface of the frusto-conical tip 31 to create a peripherally extending fault line 100b. In contrast to the embodiment shown in Figs. 12 and 13, the stop plate 95 is situated adjacent the shaft of the punch 91, below the beveled, truncated end 93.

Consequently, the thermoplastic web F is formed around the beveled end 93 as well as the right cylindrical shaft 91a. As can best be seen in Fig. 13a, the resulting frusto-conical tip 31 has a breakaway tip 35, a permanent projection 33, and a bright cylindrical section 33a. The right cylindrical section 33a is provided so a cap may be securely engaged with the tip 31.

In an alternative embodiment illustrated in Figure 12b, a single punch 91B has a spherical tip 93A. The spherical tip 93A engages the thermoplastic web F to form a hollow mound protrusion. As embodied, the thermoplastic web F is first clamp beneath a stop plate 95A. Thereafter, punch 91B advances, whereupon the spherical end 93A forms web F into a hollow mound. Furthermore, the punch 91B is advanced forwards anvil 71A until the outer surface of the web F engages the peripheral edge 77A of anvil member 71A, thereby creating a fault line that extends around the tip of the mound structures. It has been found that the spherical tip 93A allows for self alignment of the punch 91B as the web F engages the peripheral edge 77A of the anvil 71A.

Referring now more particularly to Figs. 15-18 of the accompanying drawings, there is illustrated an alternate embodiment of the dispenser package of the present invention, indicated generally by reference numeral 200. As here embodied, cover 211 includes a lateral extension 211a which extends beyond one end of the container pouch 222 and both the aperture-forming structure 230 and reclosure cap member 240 are formed in cover extension 211a. A shallow channel member 250 communicates aperture-forming structure 230 with the contents of pouch 222. Further alternatively, as shown in Fig. 17, lateral extension 211a of cover 211 is formed on an angle with respect to cover 11 so as to slope toward the pouch side of cover 11.

It has been found that the embodiments of Fig. 14-17 are advantageous in that they facilitate dispensing the contents of the package onto a surface, such as butter or cream cheese onto a slice of bread or toothpaste onto a toothbrush.

5 Referring now more particularly to Figs. 18-20, there are shown several other alternative embodiments of the cap member of the present invention. Thus, as shown at Fig. 18, the top of resealing cap 110 may include bristles or nubs to function as a brush member; as shown in Fig. 19, the top of cap 110 may have a flattened surface 270 capable of functioning as a spreading tool; as shown in Figs. 20a-d, cap 110 may be open-ended and have a shaped edge configuration, such as shown at 280,
10 281, 282, 283, respectively, so that the contents of the package may be expelled in a shaped stream.

With reference to Figures 21a-b and 22a-c, an alternate embodiment of the present invention will now be shown and described. In accordance with this alternate embodiment, an independent thermoformed unit is used to create an outlet
15 aperture in a container. The independent thermoformed unit may take the form of a reclosable outlet forming structure 300. The reclosable outlet forming structure 300 may generally comprise a cap 310, a tether 320, a base 330, and a breakaway outlet tip 340. Cap 310 may be connected to base 330 via tether 320. Score 325 facilitates separation of the cap 310 from structure 300. The reclosable outlet forming structure
20 300 may have a pre-applied adhesive or sealant in the area surrounding the base 330 to facilitate application of the structure 300 to a container, such as milk container 302. As such, the structure 300 may be sealably or adhesively attached to any surface of a container requiring the subject outlet. In particular, the structure 300 may be sealed or adhered to the container in an area surrounding a hole in the container, but not in the
25 area of the cap 310 or tether 320 which must be free of the container's surface. It is to be understood that reclosable outlet forming structure 300 may be attached to containers, such as milk carton 302, prior to filling. As such, the structure 302 may be applied to a container when it is still a flat blank.

30 With reference to Figures 22a-d, use of the reclosable outlet forming structure 300 will now be shown and described. With reference to Figure 22a, prior to shipping of the container 302, the cap 310 may be placed over the outlet forming structure base 330 prior to removal of the breakaway tip 340 so as to assure that the

breakaway tip 340 does not accidentally break and the contents of container 302 do not escape while the container 302 is in transit. With reference to Figure 23b, the cap 310 is removed from base 330 to provide access to breakaway tip 340. The container at this point is ready for opening. With reference to Figure 23c, the breakaway tip 340 is then removed to create an opening 350. Opening 350 leads to a hole (not shown) in container 302 to allow pouring the contents of container 302 therethrough. With reference to FIG. 23a, the reclosable outlet forming structure 300 may be resealed by simply placing the cap 310 over base 330.

In one embodiment of the present invention, base 330 and tip 340 are cylindrical or substantially cylindrical, although it is to be understood that other shapes may be used. In this embodiment, the opening 350 is made of PET-PVC-BAREX. It is to be understood, however, that other materials in accordance with the present invention may be used.

As can be seen in Fig. 22d, the cylindrical outlet 330 and opening 350 act a nozzle direct the flow of the contents of the container 302 into a control stream.

With reference to Figures 23-26, a low profile breakaway tip and cap in accordance with another embodiment of the present invention is shown. In general, lowering the height of a breakaway tip 360 will lower the possibility that the tip 360 may be accidentally opened during transit or by handling. Lowering the height of the breakaway tip makes it more difficult, however, to grasp and remove the breakaway tip. This difficulty is alleviated by creating undercuts or indents 370 in the sidewall of the breakaway tip 360. These undercuts or indents 370 allows a user's finger to hook and break away the tip 360 in a single motion. Figure 25 is a perspective view of the low profile breakaway tip with the removed breakaway tip shown in phantom. With continuing reference to Figures 23-25, the undercuts or indents 370 are preferably arranged in opposed positions to facilitate ease of use and manufacture. It is to be understood that the number and location of the undercuts/indents 370 may be varied. Once the breakaway tip 360 is removed from base 380, a cap 394 may be used to reclose the opening (not shown) exposed by the removal of tip 360 in base 390. Base indents 392 in base 380 are shaped and dimensioned to receive opposed inward protrusions 396 of cap 394. These protrusions 394 snap into indents 392, thereby securing cap 390 to base 380. A tether (not shown)

may also be used to attach cap 390 to base 380.

As shown in Figs. 23a and 24a, the base 390a may have generally triangular cross-sectional area. Such a cross-sectional area, may aid in the dispensing of various materials. Furthermore, the relatively large bottom of the base 390a helps avoid accidental toppling of a container.

It is also to be understood that this embodiment of the present invention may be used in a wide variety of applications, including dispensers for creamers, unit dose medications, salad dressings, beauty aids, dental products, condiments, candy confections, syrups, granular products, etc. It is also to be understood that this embodiment of the present invention may be manufactured by utilizing a male punch member in conjunction with a self-centering and receding female anvil system, as previously shown and described.

Although the use of a tether limits the rotation of a cap pressed onto a base formation, a twist-lock or twist-threading arrangement may also be used to secure the cap to the base. With reference to Figure 28, such an embodiment of the present invention which utilizes a twist-lock or twist-threading arrangement 400 to secure the cap 410 to the base formation 420 is shown. In this arrangement, cap 410 has an inner protrusion 415 which engages cam surface 430 of base 420. Upon rotation of cap 410 with respect to base 420, inner protrusion 415 engages cam surface 430 to create a twist-lock or twist-thread arrangement. It is to be understood that a tether (not shown) may also be used in such an arrangement. Base 420 may also have a breakaway tip 425 attached thereto.

As an alternative to the breakaway tip and tethered cap arrangement, the present invention also includes a tethered plug/punch and scored surface arrangement as shown in Figures 28a-c, 29a-d and 30a-d. Figures 28a and 28b are perspective views of such an embodiment of the present invention in which a tethered plug is used to open and close a pre-scored surface. In this arrangement 450, a plug 460 is used to open a pre-scored surface 470 of outlet 480. In this embodiment, the score is in the form of an interrupted circle, although it is to be understood that other types of scored surfaces, such as those shown in Figures 29a-d, may also be used. Figures 28b and 28c depict a flap 485 which is created when plug 460 is used to penetrate the scored surface 470. A tether 490 may also be created through the use of a

score 495 in arrangement 450. Plug 460, which may be connected to arrangement 450 via this tether 490, may also be used as a cork to close the outlet hole. As such, plug 460 may be used both as a plug and as an opening tool to create and/or plug an aperture in the pre-scored surface. In this embodiment, plug 460 has a conical shape, although it is to be understood that other shapes may be used. Similarly, as shown in Figures 28a and 29a-d, the score may have a partially circular shape, a V-shape, an X-shape, a star shape, or box shape, although it is to be understood that other patterns may also be utilized. Depending on the shape of the scored surface, the flap created by the penetration of plug 460 will differ. For example, the penetration of scored V-shaped surface 490 will create a flap 491; the penetration of scored X-shaped surface 492 will create a flap 493; the penetration of scored star-shaped surface 494 will create a flap 495; and the penetration of a scored surface 496 will create a rectangular-shaped flap 497.

An alternative embodiment of the present invention will now be discussed with reference to Figs. 31-36. In accordance with this alternative embodiment, a container 500 is provided with a reclosable outlet forming structure 510. More specifically, the outlet former structure 510 comprises a curvilinear dome or mound 530 and a dual purpose punch/plug 520. As will be apparent to one of skill in the art, the container 500 includes a hole, not shown, over which the mound 530 is secured. Because the punch/plug 520 must be lifted and inverted for insertion into the scored area 532, it must not be sealed to the container 500. On the other hand, the mound 530 portion of the outlet forming structure 510 must be securely adhered over the hole in the container 500.

As can best be seen in Fig. 34, the outlet forming structure 510 comprises a layer of foil 534 laminated to the plastic forming the outlet forming structure 510. The portion of the foil 534 underneath the mound 530 should be unsupported other than the adhesive used to secure it to the mound 530. It should also be noted that the foil 534 is secured to the container 500, about the hole in the container 500, so that the contents do not leak out beneath the outlet forming structure 510. The foil laminated adhesive should be one that gives adequate adhesion but sets up with minimal tensile strength of its own. In alternative embodiments, the adhesive may approach being brittle.

The mound 530 further includes a fault line pattern or scored pattern 532. The fault lines 532 may take on any number of patterns, such as those shown in Figs. 29a-d. As shown in Figs. 35 and 36, the foil 534 is laminated to the entire surface of the mound 530 and preferably, is not scored. In an alternative embodiment, the adhesive may be omitted from the fault line pattern 532.

The punch/plug 520 is secured to the outlet forming structure 510 via a tether 524. The tether 524 is created by a cut 522 through the foil/plastic laminate. As can best be seen in Fig. 32, the cut 522 preferably takes a curvilinear path, following the periphery of the outlet forming structure 510. Such a cut 522 provides an elongated tether 524.

In operation, the punch/plug 520 is firmly pushed into the fault line pattern 532 to rupture the scored mound 530. This operation is best shown in Fig. 35. Having forced the punch/plug 520 through the scored area 532 of the mound 530, an opening for dispensing the contents of the container 500 is formed. The punch/plug 520 is removed from the mound 530 so that contents of the container 500 may be dispensed. Because the scored area 532 has been deformed to the shape of the punch/plug 520, the punch/plug 520 may be reinserted into the scored area 532, thereby resealing the container 500.

In an alternative embodiment, however, the foil layer 534 may span the hollow base of the mound 530 by being laminated only to the periphery of the mound. Of course, in such an embodiment, the punch/plug 520 must be long enough to extend past the plane of the foil 534 so that the foil 534 may be punctured. By wobbling the punch/plug 520 while inserted into the mound 530, the opening in the foil is enlarged.

It should be noted that the mound 530 strengthens the outlet forming structure 510. Furthermore, the shape of the mound 530 provides a nozzle function, directing the contents of the container 500 in an even stream. Depending upon the contents of the container 500, the dimensions and shape of the mound 530 may be altered to provide the desired flow.

The outlet forming structure 510 of Figs. 31-36 are preferably manufactured with a punch similar to that described with reference to Fig. 12b. Of course, the tip of the punch need not be spherical, but rather may be elliptical, parabolic, or any curvilinear shape. Furthermore, it is preferred that the foil and

plastic be laminated into a single web prior to the formation of the mound by the punch. Thus, the dimensions of the mound, as defined by the shape of the punch tip, will be limited only by the physical properties of the materials used.

5 In an alternative embodiment, which will now be described with reference to Figs. 37-38, a reclosable outlet forming structure 610 according to the present invention is utilized with a flexible plasti-foil pouch 600. In general, the foil pouch 600 is formed by folding a generally rectangular shaped piece of the foil plastic combination in half and sealing the three open edges thereof. A reclosable outlet forming structure 610 is mounted on the seamless end 605 of the pouch 600. The
10 outlet forming structure 610, which is sealed to the seamless end of the pouch 600 by applying an adhesive around a periphery of the base 612, covers a hole, not shown, in the pouch 600.

The outlet forming structure 610 may be of any type previously disclosed above, such as those described with reference to Figs. 1-3, 8-9, 13, and 13a.
15 In a preferred embodiment, as shown in Figs. 37 and 38, the outlet forming structure 610 includes an aperture forming protrusion 630. More specifically, the aperture forming protrusion 630 includes a hollow cylindrical base 632 and a break-away tip 634. A fault line 636 extends around the periphery of the protrusion structure 630, permitting the breakaway tips 634 to be broken away from the base 632 in the tip 634.
20 More specifically, the fault line 636 is a narrowed, stress concentrating area.

The outlet forming structure 610 also includes a cap 620. The cap 620 is a hollow tapered member, which has an inside base diameter slightly larger than the outside diameter of the base 632 of the protrusion structure 630. The cap 620 is secured to the outlet forming structure 610 via a tether 624. The tether 624 is formed
25 by a cut 622 through the lower surface 612 of the outlet forming structure 610. As can best be seen in Fig. 39, the curvilinear cut 622 separates the cap 620 from the protrusion structure 630 and follows the periphery of the base 612. By having such a pattern, the cut 622 is relatively long and, consequently, produces a relatively long tether 624. Due to the long tether 624 and the fact that the portion of the base 612 that
30 supports the cap 620 is not fastened to the pouch 600, the cap 620 may be raised and securely placed over the outlet forming structure 630.

In operation, a user applies sidewise finger pressure to the protrusion

tip 634, thereby causing it to break away from the protrusion base 632 along a fault line 636. Because the protrusion structure 630 is substantially hollow, an aperture, not shown, is created. Furthermore, because the protrusion member 630 has been affixed to the pouch 600 over a hole in the pouch, not shown, the contents of the pouch 600 may be dispensed via the now opened protrusion neck 632. The cap 620 is placed over the base 632 during shipping, so that accidental rupturing of the fault line 636 is prevented. Furthermore, cap 620 is placed over the base 632 to reclose the package 600 when only a portion of the contents of the package 600 has been dispensed.

In an alternative embodiment, shown in Fig. 39, the same outlet forming structure 610 is secured to the side of pouch 640. In this embodiment, the pouch 640 is formed from two generally rectangular sheets of foil plastic laminate which are sealed together around all four sides of each sheet. As with the previous embodiment, the protrusion structure 630 is affixed to the pouch 640 over a hole, not shown, so the protrusion neck 632 is in fluid communication with the contents of the pouch 640.

An alternative embodiment of the present invention employing an outlet forming structure 610a disposed on a foil pouch 640a will now be described with reference to Figures 37a, 38a, and 39a. Briefly described, the outlet forming structure 610a is substantial the same as the outlet forming structure described with reference to Figures 37-39. Specifically, the outlet forming structure 610a includes both a cap 620a and a protrusion member 630a. As best seen in Figure 39a, the foil pouch 640a includes a lap seam on the side opposite the outlet forming structure 610a.

An alternative embodiment of the present invention will now be described with reference to Fig. 40. A tethered punch/plug and base member with a star shaped fault pattern manufactured as a unit 700 is shown. A tether 730 is connected to the base 710 at a proximal end thereof, a ring structure 740 connected to a distal end thereof, and a tapered punch/plug 760. The punch/plug 760 is manufactured separately from the other components.

As shown, the ring structure 740 defines an opening 750. The opening 750 is larger than the tip 762 of the punch/plug 760 yet smaller than the base 764 of the punch/plug 760. Furthermore, the punch/plug 760 includes a circumferential indentation 766. The indentation 766 is formed on the punch/plug 760 just below a

point where the outside diameter of the punch/plug 760 becomes larger than the inside diameter of the opening 750.

Therefore, once the components have been separately manufactured, the punch/plug 760 is snapped into the opening 750. When snapped into the opening 750, the tapered punch/plug 760 causes the slightly elastic ring structure 740 to expand until the ring structure 740 reaches the indentation 766. Upon reaching the indentation 766, the ring structure 740 snaps into the indentation 766. Consequently, the punch/plug 760 becomes connected to the ring structure 740 and the other components.

In use, as shown in Figure 40a, the punch/plug 760 is used to puncture the scored section 722 of the protrusion structure 720. Such operation is described in greater detail with reference to Figs. 28-30d.

Turning now to Fig. 41, one embodiment for manufacturing a reclosable outlet forming structure according to the present invention is shown. Specifically, a pair of reclosable outlet forming structures 870 and 880 are formed from the same piece of thermoplastic web F. Each reclosable outlet forming structure 870, 880 comprises a protrusion structure 872, 882 as well as cap 874, 884, respectively. As in the previously disclosed embodiments, each cap 874, 884 is connected to the corresponding protruding structure 870, 880 via a tether 876, 886.

It is to be understood that the mating, horse-shoe arrangement of the outlet forming structures 870, 880 provides several benefits, such as reclining wasted portions of the web F, and that the manufacturing agreement may be repeated along the length of the web F.

Turning now to Figures 42-44, an alternative embodiment of the present invention is shown. Initially, it should be noted that the container 1000 shown is made of similar materials as described above with reference to Figure 1-3.

The container 1000 comprises a first deformable pouch 1010 and a second deformable 1020. The two pouches 1010, 1020 are joined by a shallow conduit 1030. The deformable pouches 1010, 1020, as well as the joining conduit 1030, are sealed by a generally flat sheet 1040 of thermoformable plastic material. A hollow protrusion 1050 is integrally formed with the flat sheet of thermoformable plastic 1040. The hollow protrusion 1050 extends from the flat sheet 1040. The

protrusion 1050 is directly above and in fluid communication with the conduit 1030. The container 1000 further includes a punch/cap 1060.

As can best be seen in Figure 43, the hollow protrusion 1050 has scores or fault lines 1055 on the top face thereof. Despite these fault lines 1055, which
5 weaken the protrusion 1050, the container 1000 remains sealed. Further shown in Figure 46, the punch/cap 1060 is partially separated from the remainder of the container 1000 by cut 1062. The cut 1062 which parallels one peripheral edge of the container 1000 creates a tether 1064.

In order to open the container 1000, the punch/cap 1060 is positioned
10 over the protrusion 1050. The punch/cap 1060, and more specifically the pointed end 1066 of the punch/cap 1060 is forced through the score or fault lines 1055, thereby opening the hollow protrusion 1050. When punch/cap 1060 is removed from the hollow protrusion 1050, an opening, not shown, exists. The opening is formed by the permanent deformation of the portion of the protrusion member 1050 between the
15 fault lines 1055. By inverting the container 1000 and gently squeezing either or both of the pouches 1010, 1020 the material contained within the pouches is dispensed via the opening in the protrusion 1050.

It should be noted that in the preferred embodiment the protrusion 1050 is placed directly above the conduit 1030. As a result, the contents of the pouches
20 1010, 1020 can be dispensed in a controlled manner. Specifically, the shallow conduit 1030 provides resistance to the flowing contents so that the contents do not spout from the opened protrusion 1050 uncontrollably, particularly when the protrusion 1050 is initially punctured.

As shown in Figure 44, should less than all of the material contained
25 within the pouch 1010, 1020 be dispensed, the container 1000 may be reclosed. Specifically, the punch/cap 1060 is inverted by twisting the tether 1064. Because the punch/cap 1060 is hollow, having an inside diameter substantially the same as or slightly larger than the outside diameter of the protrusion 1050, the punch/cap 1060 can be securely placed on the protrusion 1050.

30 With regard to the embodiment of Figures 42-44, it will be apparent to one skilled in the art that the invention is not limited by the type of outlet forming structure utilized. Specifically, any combination of break away tip, scored protrusion

member, punch, plug, and cap may be employed. Furthermore, it should be understood that the particular shape of the pouches may vary according to the properties of the contents held therein.

5 An alternative embodiment of the present invention will now be described with reference to Figures 45-47. As shown in Figure 45, an outlet forming structure 1070 comprises a cap member 1072 and an aperture forming protrusion 1074. As with the embodiments discussed above, the cap member 1072 is connected to the aperture forming structure 1074 by a tether 1076. As can be seen, both the cap member 1072 and the aperture forming structure 1074 are formed in a curvilinear base 1078.

10 Because the outlet forming structure 1070 is formed in a curvilinear base 1078, it may be positioned on a container 1080 having a similar curvilinear surface. As shown in Figures 46a-c, one such container 1080 is generally spherical and formed in two halves 1082, 1084. The two halves 1082, 1084 are joined at one point along their circumferences, and are therefore hingeably connected. One half 1084 of the container 1080 includes an aperture 1086 formed therein.

15 In operation, as shown in Figure 47, the outlet forming structure 1070 is affixed to the container 1080 such that the aperture forming structure 1074 is in alignment with the aperture 1086 in the container 1080. As further depicted in Figure 47, the cap member 1072, shown in a sectional view, may be positioned over the aperture forming structure 1074, thereby protecting it and sealing the container 180. It is to be understood that the shape of the container 1080 is merely representative of those that may be employed with the present invention, as the outlet forming structure may be formed on a curvilinear base having virtually any shape.

20 Another alternative embodiment of the present invention will now be described with reference to Figures 48-51. The container 1090 generally comprises a rectangular sheet 1091 of thermoformable material. At the center of the rectangular sheet 1091 is an aperture forming structure 1092, having a base and break away tip as described above with reference to the prior embodiments. On either side of the aperture forming structure 1092 are pouches 1098 formed on the underside of the sheet 1091 for holding any flowable substance. The pouches 1098 are in fluid communication with the aperture forming structure 1092.

Also formed in the rectangular sheet 1091 of thermoformable material is a cap member 1094. The cap member 1094 is preferably formed in one corner of the rectangular sheet 1091 and attached to the container 1090 via a tether 1096. The tether 1096 is formed by a cut 1097 extending along the perimeter of the container 1090.

The container 1090 may be folded generally in half along bending grooves 2006 disposed on either side of the aperture forming structure 1092. Specifically, the ends of the container 1090 are brought together as depicted by arrows "A" in Figure 49. Once the ends are brought together, a female package tie 2000 and a male package tie 2002, both of which are integrally formed in the sheet of thermoformable material 1091, are brought into engagement.

Engagement of the female package tie 2000 and the male package tie 2002 hold the container 1090 in the configuration as shown in Figures 50 and 51. In operation, lateral finger pressure on the tip of the aperture forming structure 1092 causes a fault line to rupture, thereby forming an aperture in the aperture forming structure 1092. Thus, the contents of the container 1090 may be dispensed from the aperture. As shown in Figure 51, the cap member 1094 may be placed over the aperture forming structure 1092, thereby preventing accidental rupturing of the fault line or accidental dispensing of the contents after the tip of the aperture forming structure 1092 has been removed.

Another alternative embodiment of the present invention will now be described with reference to Figures 52-54. As shown in Figure 52, an aperture forming structure 2016 according to the present invention may be positioned on a treated paper board tube 2012, thereby forming a sealed container 2010. The aperture forming structure 2016 comprises a generally hollow frusto-conical portion 2018, a hollow cylindrical portion 2019, and a breakaway tip 2020. Integrally formed with the aperture forming structure 2016 is a cap member 2022 and an associated tether 2024. As can best be seen in Figure 54, the tether 2024 is formed by a curvilinear cut which allows the cap member 2022 to be partially separated from the aperture forming structure 2016 so that the cap member 2022 may be positioned over the cylindrical portion 2019 and the breakaway tip 2020. Because the cap member 2022 has an inside diameter slightly larger than the outside diameter of the cylindrical portion 2019, the

cap member 2022 fits snugly thereon, thereby sealing the container 2010.

As with the previously described embodiments, in operation, lateral pressure on the breakaway tip 2020 causes it to separate from the rest of the aperture forming structure 2016, thereby forming an aperture into the generally hollow aperture forming structure 2016. Thus, the contents of the container 2010 may be dispensed therefrom.

IMPROVED TUBELIKE TETRAHEDRAL DISPENSER PACKAGE

Figs. 37a, 38a and 39a disclose a tubelike member formed from a thermoplastic material having fin seals at each end and a longitudinal seam, so as to resemble a typical sachet or pillow-shaped container. More particularly, as shown in Figs. 37a, 38a and 39a, the fin seals on the ends of the tubular member are parallel to one another and positioned in the same plane.

The aforesaid sachet or pillow-shaped configuration, while functional, creates a flexible structure which readily bends in half when formed from thin gauge (e.g., on the order of .004" thickness) thermoplastic materials and does not handle well. It has been unexpectedly discovered, however, that by making the end seals perpendicular to each other, thereby creating an elongated tetrahedron, the resulting tubelike container is sufficiently self-supporting so as to retain its shape even when formed from various thin gauge thermoplastic materials it retains an attractive structural shape. In addition, it has been found that the elongated tetrahedral shape fits very comfortably between the fingers and thumb of a person's hand, yields to gentle hand pressure for squeezing and dispensing product, and then, surprisingly, returns to its original tetrahedral shape. Various embodiments of the tetrahedral tube appear in Figs. 55a-59c and 62a-62f.

Figs. 1-54 also disclose an easy opening outlet member in the form of a breakaway tip together with a reclosure cap member which is integrally formed and tethered to the container, such as shown, for example, at Figs. 8-9, 14, 22a, 38a and 50-51.

While functional, the tethered reclosure cap member has the disadvantage that it must be manipulated into alignment with the breakaway tip formation before closure can be accomplished, requiring a degree of dexterity such

that closure may be difficult or at least bothersome for most people. It has been found that the same easy opening breakaway tip outlet member may be formed into the body of my tetrahedrally-shaped package and that the reclosure cap may be formed in the flat fin seal. The fin seal may then be folded over at a bending line or pattern or
5 hinging section in said fin seal containing the cap.

This permits the cap member to close over the outlet opening and eliminates the alignment difficulty experienced with the previously described tethered configurations.

More specifically, the breakaway tip outlet opening may be integrally
10 formed into the body of the package on the generally flat surface near one end of the tetrahedron adjacent to the fin seal. It was furthermore found possible to form a cap into the double film of the fin seal and to put a cut into the flat portion of the fin seal to create a tether for the cap such as depicted in Fig. 55a or, alternatively, to make the entire flat fin seal containing the cap capable of acting as a hinged flap which when
15 bent or folded over onto the body of the package, automatically aligns and places the cap over the breakaway tip outlet creating formation as shown in Figs. 56a-56c. The hinge feature may be an articulated or multiple hinge in order to align the cap with the breakaway tip formation (sort of double jointed). It may in some instances, depending on the material, simply be a weakened section. This hinged flap configuration is a
20 particularly convenient and easy to use version of the system and has quite a finished and pleasing appearance as can be appreciated from Figs. 58a-58c. With reference to Figures 58d-58g, in testing the fit and handling of the cap in the hinged member to the breakaway tip it was discovered that changing the angle that the tip meets the cap when closing the cap down on the tip greatly improved the cap's ability to close on the
25 tip and remain in place after being closed. This angle change was accomplished in one instance by making a pair of small sealed areas (adjustment seals) one on each side of the breakaway tip assembly. Other means of alignment correction are available to anyone skilled in the art of thermoforming plastics.

It is to be understood that the various opening and closure concepts
30 described in connection with Figs. 1-54 may also be used with the tetrahedral tube. For example, it is possible to use the combination of a punch/plug and pre-scored surface, such as depicted in Figs. 28a-30d, with a tetrahedral tube.

With reference to Figures 58h-58i, in a further development it was found that the breakaway tip formation was improved and sturdier if a slightly heavier gauge of thermoplastic were used. If Barex were used, for example 7 mil. instead of 4 or 5 mil., which could be adequate, it would raise the cost of the package. It was then realized that the only portion of the entire package that was in fact thermoformed and therefore had reduced thickness was the breakaway tip and that instead of using heavier gauge Barex or other thermoplastic throughout, a heavier gauge would be created just at the locus of the tip by sealing a small patch of, for example, 2 mil. Barex or Barex/PVDC to the thickness of that thermoformed area alone. With this accomplished the rest of the tetra-tube could be reduced to 4 mil. and since the weight of the PVDC coating (6#) wasn't reduced in any area other than at the tip an overall reduction of the amount of PVDC used could be dropped to either 4, 3 or even 2 lbs. per ream with significant cost reductions possibly in the range of 10-12%.

In another version utilizing the novel tetrahedral tube configuration, a fault line with at least one curved section located just beneath the fin seal can be used to create an aperture by simply bending the section it traverses at said fault line. If the structure is made of a frangible plastic such as high impact polystyrene (HIPS) or Barex (Ba), it will rupture along the fault line to create an arched outlet shaped by the curved section of said fault line. This embodiment is depicted in Figs. 62a-62f.

One of the significant advantages of the tetrahedron-shaped tube of the present invention is their one third to one half cost of traditional tubes. A basic reason for this extremely user-friendly tube having such a low cost is that the breakaway tip and cap or other outlet creating means, is formed on a side or face of the tube body, rather than at the end of the tube as in traditional tubes. An end mounted outlet is very costly to manufacture as it requires an injection molded end fitting to create the outlet plus a separately molded threaded fitting or other cap member to effect the closing of the tube. This entire separately molded end member must then be attached or bonded to the product containing portion of the tube. In sharp contrast, the subject elongated tetrahedral tube is made entirely from a single sheet of plastic with both the outlet creating means and the reclosing means integrally thermoformed into it. The preferred film materials for toothpaste are Barex coated with PVDC (Saran), although other base materials and or multi-layer materials, as described above, can also be used. For other

products less demanding than toothpaste, i.e., products with less corrosive and/or abrasive properties, such as frostings, food pastes, hand creams, hair gels, etc. which require fewer barrier and chemical resistance properties, simple monolayer polypropylene (PP), or high density polyethylene (HDPE), or either with PVDC coatings may be used or even PVDC coated HIPS.

Another use for the breakaway tip with hinged reclosure cap member of the present invention is to make it as a separate unit as seen in Figs. 60a-60c and attach or adhere it to another package or container. The gable top milk container depicted in Figs. 61a-61c is an important example of such packaging.

A variety of refinements may be made to the reclosure cap member and the breakaway tip formation to improve the effectiveness of the closure. In the embodiment depicted in Fig. 63, the breakaway tip formation is angled away from the adjacent seal fin such that when the reclosure cap member is placed over the tip formation it will result in a more secure closure. In another embodiment depicted in Figs. 64a-64b, the cap is formed with a flat portion on one side so as to better grip the breakaway tip formation. In still another embodiment depicted in Fig. 65, tacky, reusable, re-sealing adhesive is applied to the surface of the hinged flap which contacts the tetrahedral tube when the reclosure cap member is in the closed position. This facilitates more effective closure by creating adhesion between the hinged flap and the surface of the tetrahedral tube. The adhesive may be applied to the hinged flap in the shape of spots, lines, or in other patterns which will be apparent to those skilled in the art.

It will be understood that the tetrahedral tube with hinged end may be made of other than thermoformable materials such as paperboard, suitably treated or coated, foil-plastic laminates and/or combinations of layers of materials where the cap member embodied in the hinge is a separately formed member or fitting attached to or through said hinge and the opening or outlet feature is similarly applied to or mounted on or through the tetrahedral tube on one of its faces.

Cap member may be a snap-on style like a snap fastener to close on the outlet feature or it may be so fitted to or through the hinge as to be rotatable to make it a twist-on or screw-on unit. Figs. 66a-66d generally depict these embodiments of the present invention. While it will be seen that these additions add cost, they can in

quantity production be made and attached to the tetrahedral hinged tube economically and still create a very low cost tube. It will also be understood that all of the various opening and closure concepts described in Figs. 1-54 may be embodied in the hinged tetrahedral tube.

5 With reference to Figures 67a-g, the steps of the manufacturing process of the flat-style and tetrahedral-style tubes of the present invention are shown. Figures 67a depicts the base film 2900 used in forming the tube. Figure 67b depicts an optional reinforcement film 2910 which is sealed to the base film. Figure 67d shows a breakaway tip aperture forming means 2920 as formed on the base film. As shown in
10 Figure 67d, the base film is sealed into a tubular shape and a lower seal 2930 is formed, as shown in Figure 67e. Figure 67f shows the flat-style tube 2940 as formed with a cap, while Figure 67f depicts the tetrahedral-style tube 2950.

15 With reference to Figures 68 and 69, sequential fabrication diagrams for the flat-style and tetrahedral-style tubes of the present invention are shown. The tubular dispensers shown in Figures 67f and 67g are formed on a modified vertical downwardly indexing for-fill-seal machine on a continuous strip of thermoformable plastic of proper width to produce the tubular dispenser. Rest time is the time between indexes during which sealing, forming, and punching operations take place.

20 With continuing reference to Figures 68 and 69, each index is numbered. Numbers indicating a rest following an index are followed by an R. As such, 3001R follows index 3001. Index 3001 is followed by an optional small reinforcing piece of film which is sealed to the main film web at 3001R. Index 3002 is followed by the formation of a breakaway tip formed in the main film and reinforcing
25 film plastic, if used, at 3002R. At 3003, the film enters a tube forming guide assembly. The tube is formed at 3004, and the longitudinal seal, hinge seal, flap seal and final closure seal of the preceding tube are made at 3004R. At 3005, the tube dispenser is filled with a particular product. Index 3006 is followed by the punching
30 of a cap and the cutting of a tube from the following tube at 3006R. The aforementioned fabrication sequence is for the flat-style tube of Figure 68. For the tetrahedral-style tube, only a cut is made at 3006R. In either style tube, the tube drops approximately 2 inches into the fixture where it is cut and held while the cross seal

bars cross seal simultaneously with the cap being punched.

With reference to Figure 70, a perspective view of a flat-style tube with a splayed base 3010 in accordance with another embodiment of the present invention is shown.

5 Figures 71 and 72 are side and front views, respectively, of the tetrahedral-style tube with splayed base 3012 in accordance with another embodiment of the present invention.

 Figure 73 is perspective view of a free-standing tube 3020 having a hollow insert 3022 inserted into the bottom of the free-standing tube 3020 in accordance with another embodiment of the present invention. Figures 74 and 75 are, respectively, side and front views of the free-standing tube of Figure 73. Figure 76 is a bottom view along line 76-76 of the free-standing tube of Figure 75.

 Figure 77 is a perspective view of a seamless tube 3100 in accordance with another embodiment of the present invention.

15 Figure 78 depicts a seamless tube with end seals 3110 and aperture forming means 3120 in accordance with another embodiment of the present invention.

 Figure 76 is a seamless tube 3200 with a cap 3210 and a hinged flap 3220 in accordance with yet another embodiment of present invention.

20 Figures 80 and 81 are regular and tetrahedral-style tubes 3300, 3400 using the seamless tube configuration, while Figure 82 tube is a free-standing seamless tube 3500 in accordance with yet another embodiment of the present invention.

 It is to be understood that any of the embodiments of the Figures 77-82 may include the splayed base 3010 of Figure 70.

25 Figure 83 and 84 are views of a hinge 3580 with a washboard pattern of grooves 3592 which interconnects a cap 3590 with an aperture forming means 3595.

 It will remain understood by those skilled in the art that the present invention in its broader aspects is not limited to the particular embodiments shown and described herein, and that variations may be made without departing from the principles of the invention and without sacrificing its chief advantages.

30

What is claimed is:

1. A sealed dispensing tube having an integral aperture forming means entirely made from a single sheet.
- 5 2. The sealed dispensing tube of claim 1 wherein said single sheet is made of a material selected from the group consisting of film, plastic film, thermoformable film, thermoformable plastic film, a laminated film and a laminated film including foil.
- 10 3. The sealed dispensing tube of claim 1 wherein said aperture forming means is a breakaway tip formation.
- 15 4. The sealed dispensing tube of claim 3 wherein said breakaway tip has a two-tiered formation including a base portion and a tip portion, said tube further comprising a cap.
5. The sealed dispensing tube of claim 4 wherein said base portion is covered with a resilient gasket-style material over which said cap fits.
- 20 6. The sealed dispensing tube of claim 1 wherein said aperture forming means is comprised of a fault line on the tube wall adjacent a fin seal.
7. The sealed dispensing tube of claim 1 wherein said aperture forming means includes a fault line with a curved portion on the tube wall adjacent a fin seal.
- 25 8. The sealed dispensing tube of claim 1 wherein said aperture forming means includes an aperture forming punch-plug.
- 30 9. The sealed dispensing tube of claim 1 wherein said tube has a first end fin seal disposed at one end of said tube, and a second end fin seal disposed at a second end of said tube.
10. The sealed dispensing tube of claim 9 wherein said first end fin seal is

perpendicular to said second end fin seal.

11. The sealed dispensing tube of claim 9 further comprising an integral cap formed into an integral hinged flap created from an extended fin seal, said flap
5 capable of hinging over said cap and about said aperture forming means.

12. The sealed dispensing tube of claim 9 further comprising a splayed portion extending beyond an end fin seal, wherein said splayed portion is corrugated for rigidity, said corrugations extending up and into the end fin seal.
10

13. The sealed dispensing tube of claim 1, wherein a small reinforcing piece of film is sealed to a thermoformable sheet at the locus of the aperture forming means prior to thermoforming.

14. A sealed dispensing tube having an aperture forming means and an attached integral cap completely made from a single sheet.
15

15. The sealed dispensing tube of claim 14 wherein said single sheet is made of a material selected from the group consisting of film, plastic film, thermoformable film, thermoformable plastic film and laminated film.
20

16. The sealed dispensing tube of claim 14 wherein said attached hinged cap is attached by being formed into an integral hinged flap capable of hinging over and about said aperture forming means.
25

17. The sealed dispensing tube of claim 16 wherein said hinged flap hinges by virtue of an articulated hinge.

18. The sealed dispensing tube of claim 17 wherein said articulated hinge is created by embossing parallel grooves in a washboard pattern.
30

19. The sealed dispensing tube of claim 16 wherein said tube includes

adjustment heat seals.

20. A reclosable aperture forming means member formed from a single sheet of thermoformable plastic film comprising a hinge member with a cap on one wing of said hinge and an aperture forming means on the opposite wing so located that when said hinge member is closed, said cap sits over and about said aperture forming means.

21. The reclosable aperture forming means member of claim 20 wherein said hinged member hinges by virtue of an articulated hinge.

22. The reclosable aperture forming means member of claim 21 wherein said articulated hinge is created by embossing parallel grooves in a washboard pattern.

23. The reclosable aperture forming means member of claim 20 wherein said wings include reusable resealing adhesive spots to hold said cap down on said aperture forming means.

24. A flexible, squeezable sealed tubular member for containing and dispensing product made from a single sheet of thermoformable plastic film having a longitudinal seal which extends from a first end to a second end of said tubular member, a fin seal at said first end, said tubular member comprising an aperture forming means thermoformed into a wall of said squeezable sealed tubular member and a circular hollow thermoformed member inserted in the second end with the hollow portion facing away from the interior of the tube.

25. The flexible, squeezable sealed tubular member of claim 24, wherein a small reinforcing piece of film is sealed to the sheet of thermoformable plastic film at the locus of the aperture forming means prior to thermoforming.

26. A sealed hollow member containing an easy opening aperture forming means and closure means for said aperture forming means, all thermoformed from a

single sheet of plastic.

5 27. A sealed dispensing container with an aperture forming means entirely thermoformed from a single sheet of plastic, which is reclosable after forming of the aperture.

 28. A sealed dispensing tube having an aperture forming means completely made from a single piece of film.

10 29. The sealed dispensing tube of claim 28 wherein said single piece of film is made of a material selected from the group consisting of film, plastic film, thermoformable film, thermoformable plastic film, a laminate and a laminated film containing foil.

15 30. A container comprising an outlet hole and a reclosable aperture forming means member sealingly attached to said container above said outlet hole, said aperture forming means member formed from a single sheet of thermoformable plastic film comprising a hinge member with a cap on one wing of said hinge and an aperture forming means on the opposite wing so located that when said hinge member is
20 closed, said cap fits over and about said aperture forming means.

 31. A sealed dispensing tube having an aperture forming means mounted in a wall of said sealed dispensing tube.

25 32. The sealed dispensing tube of claim 31 further comprising an attached integral cap.

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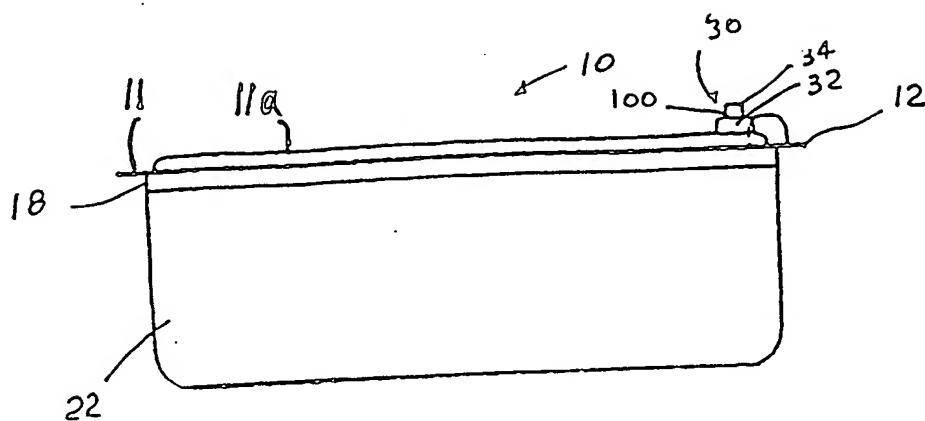


FIG 1

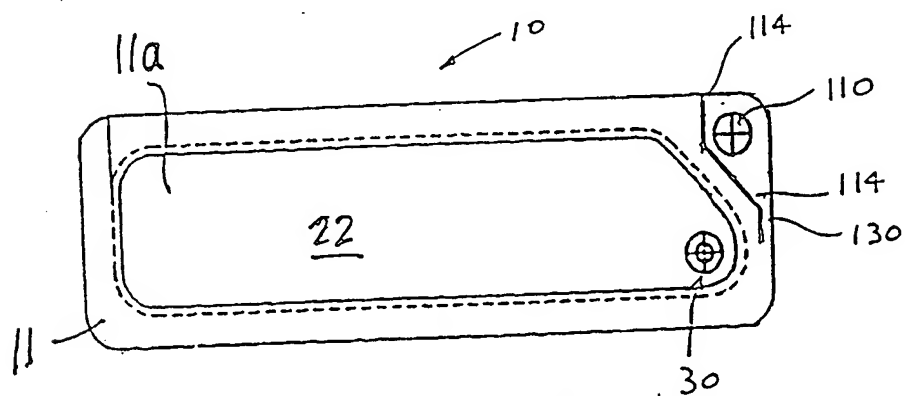


FIG 2

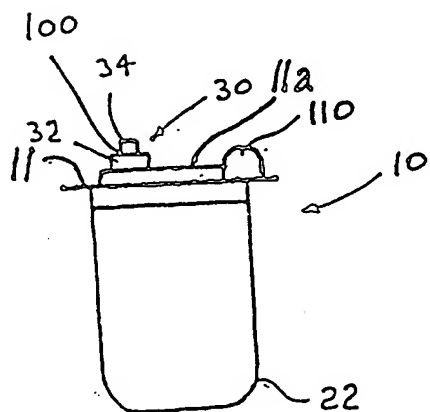
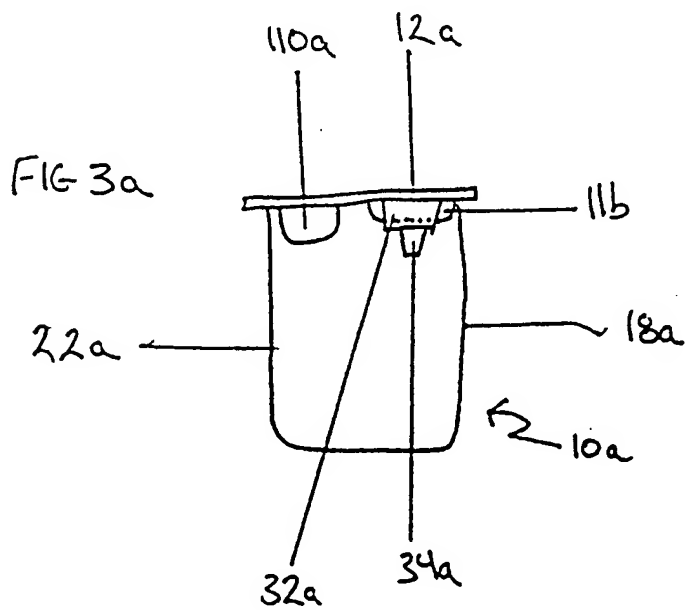
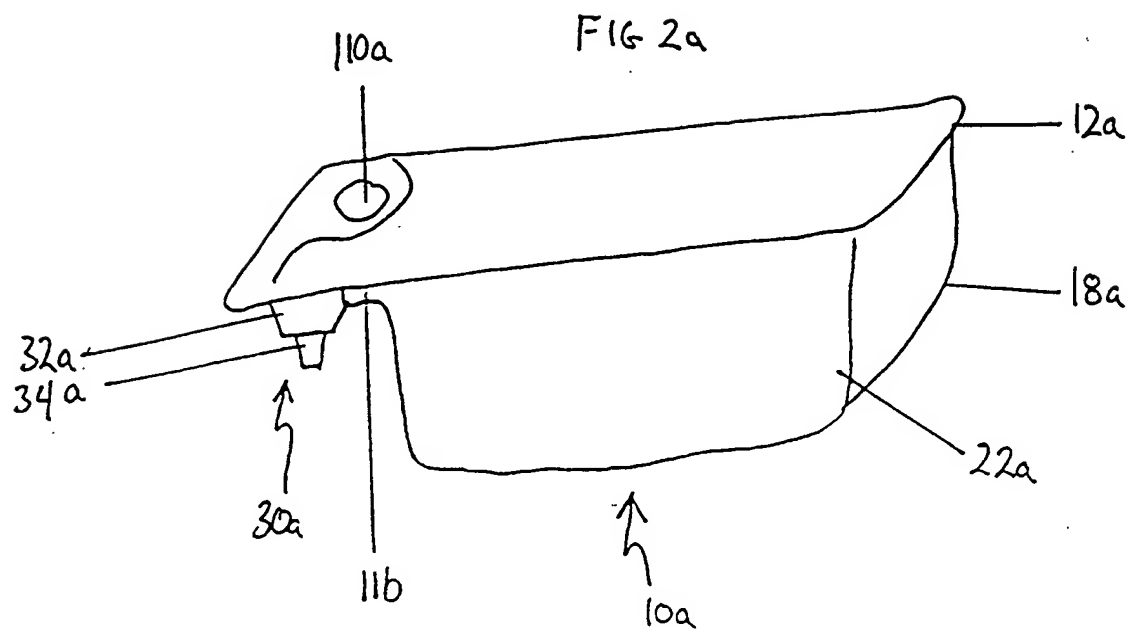
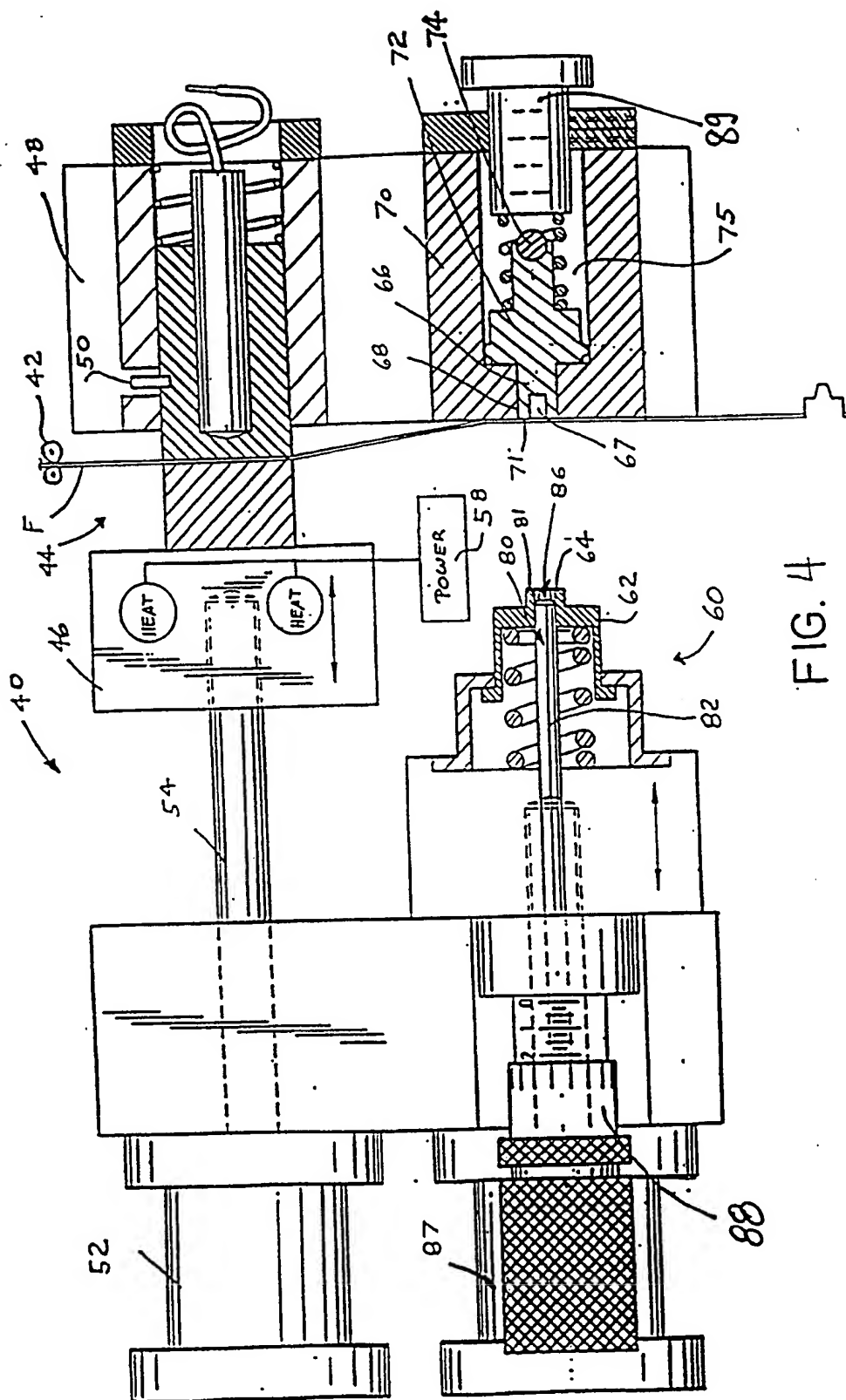


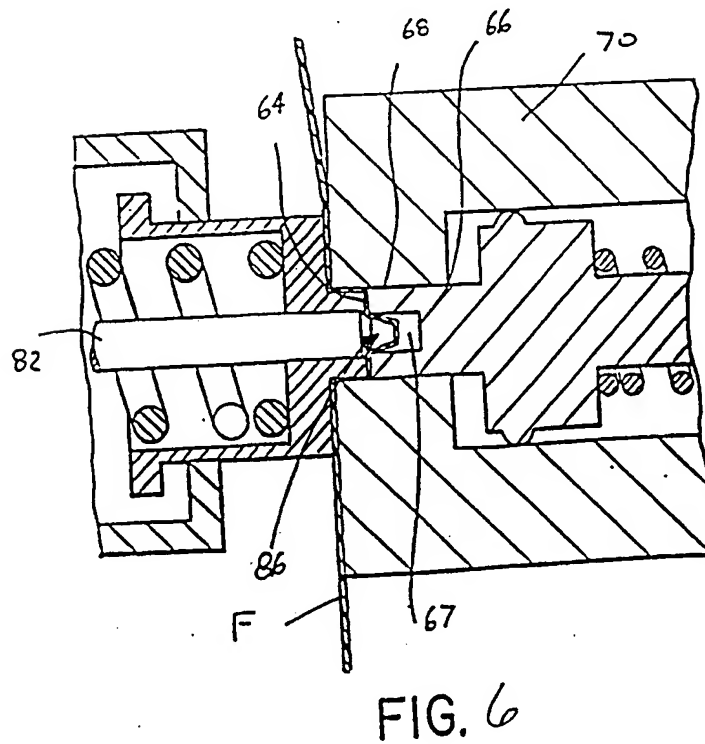
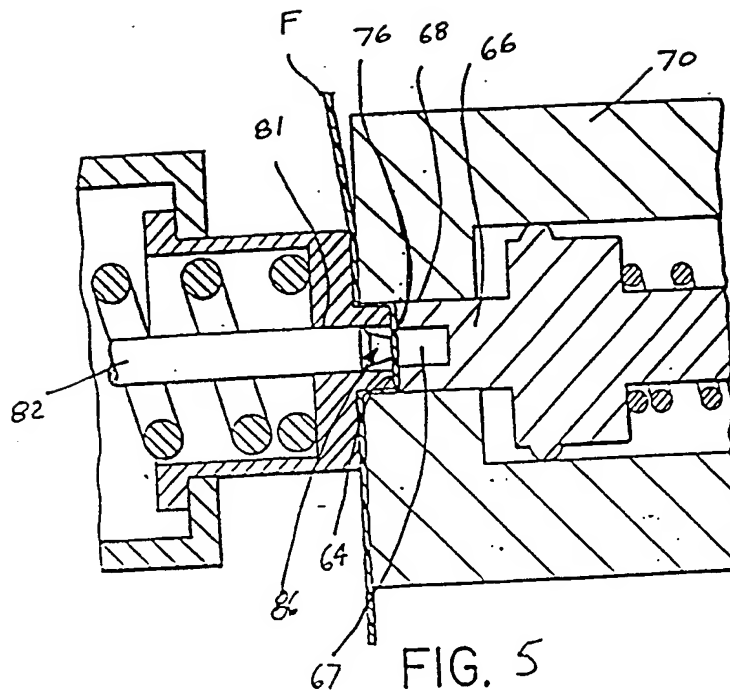
FIG 3

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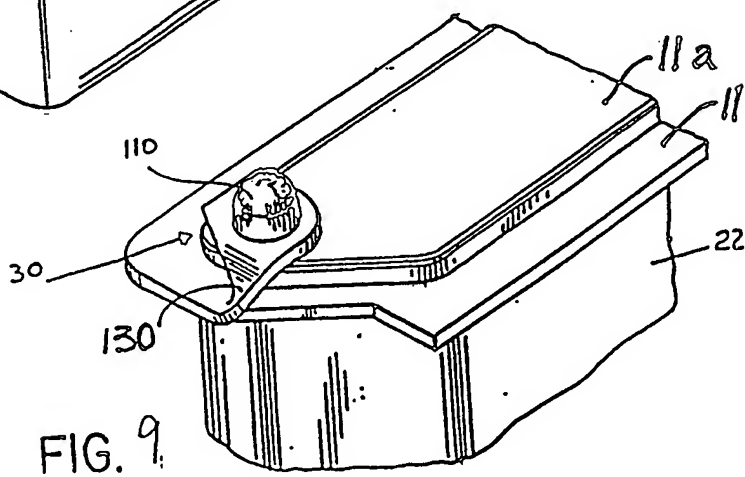
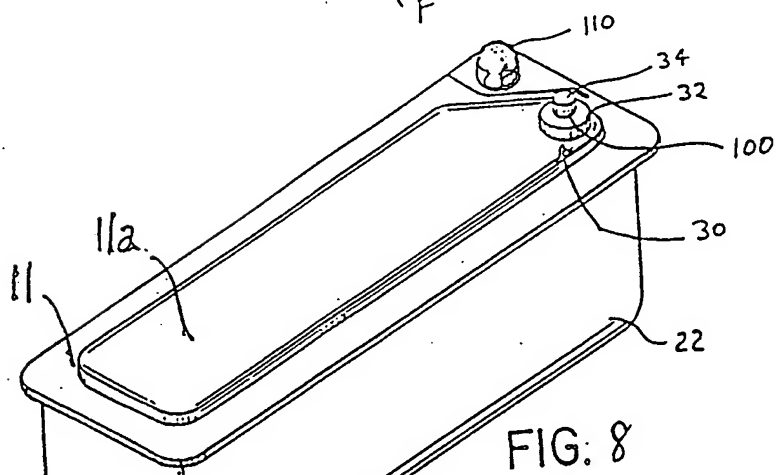
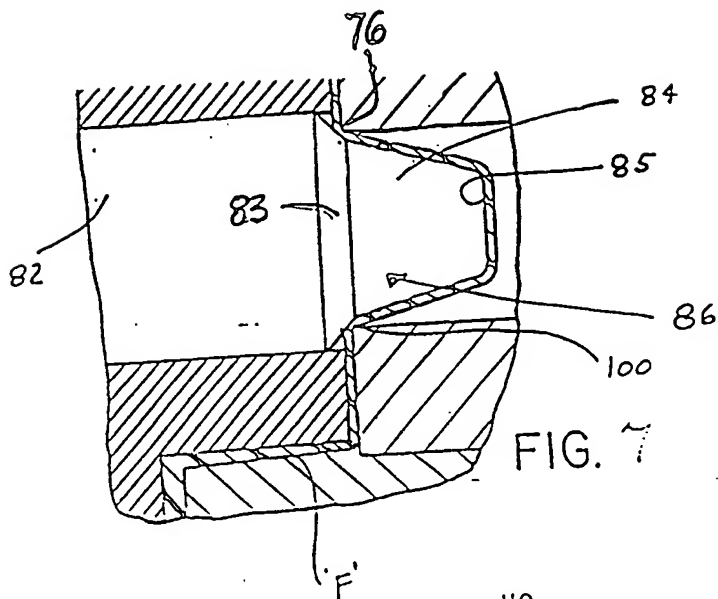




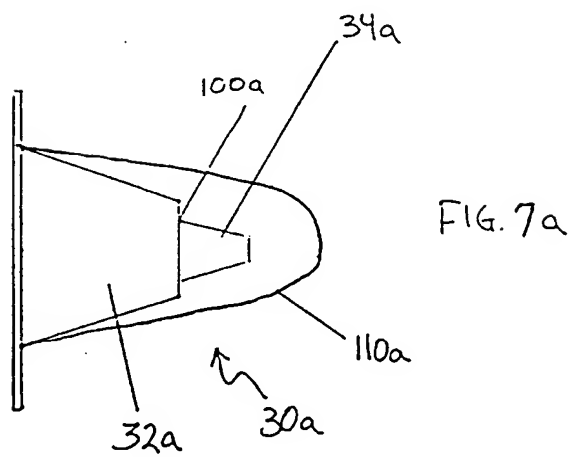
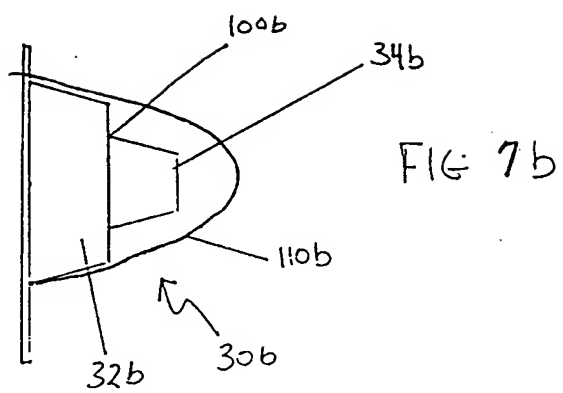
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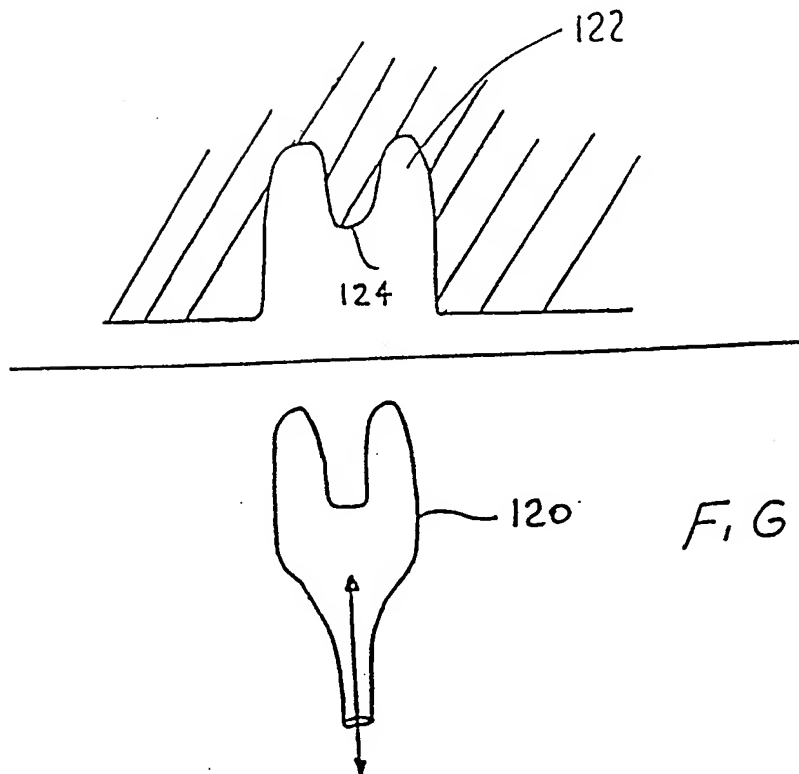
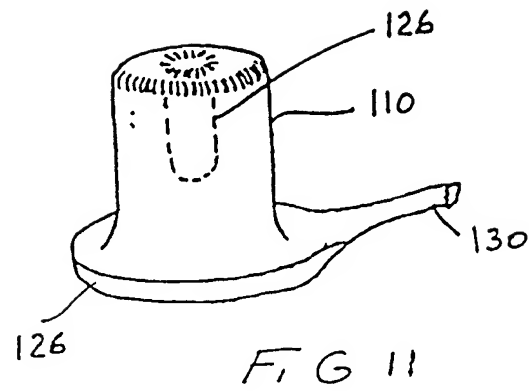
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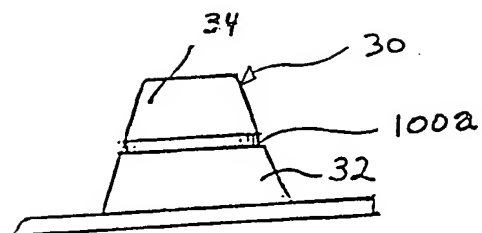


FIG 13

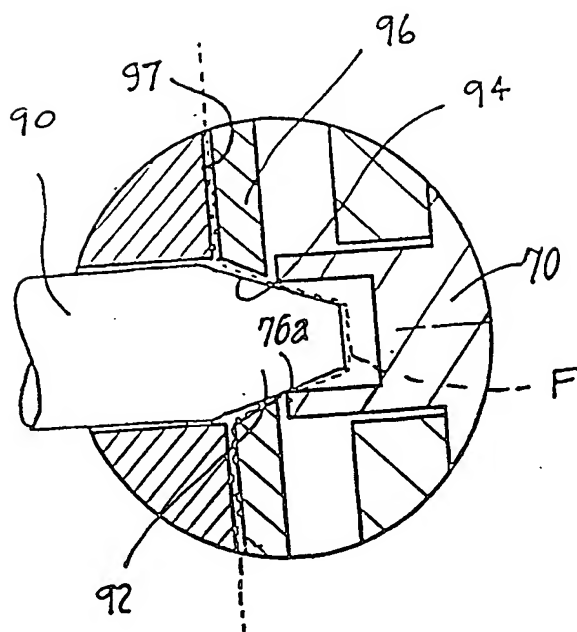


FIG 12

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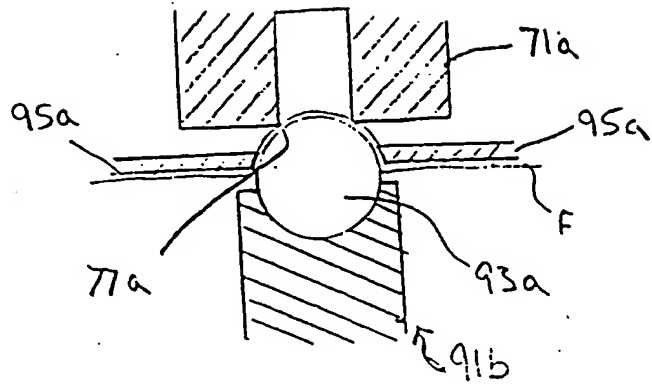


FIG 12b

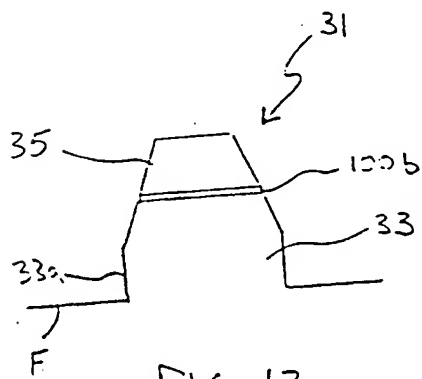


FIG 13a

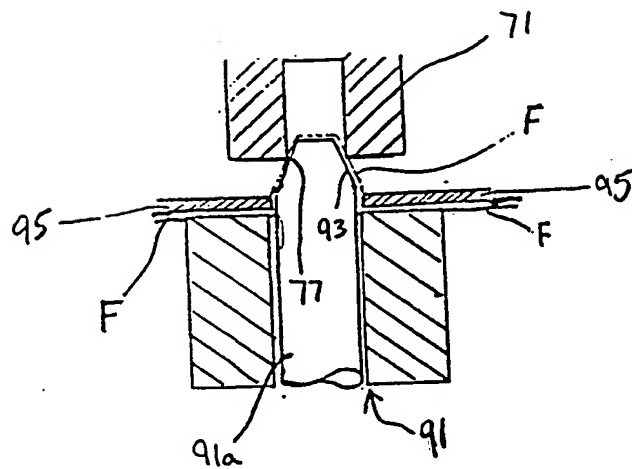
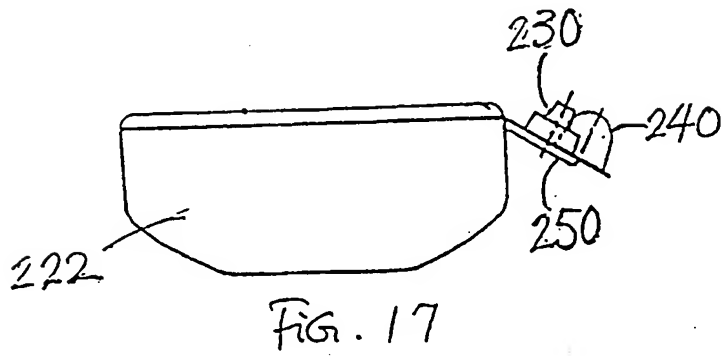
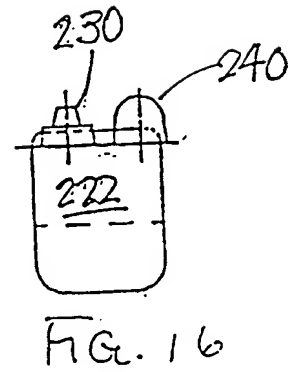
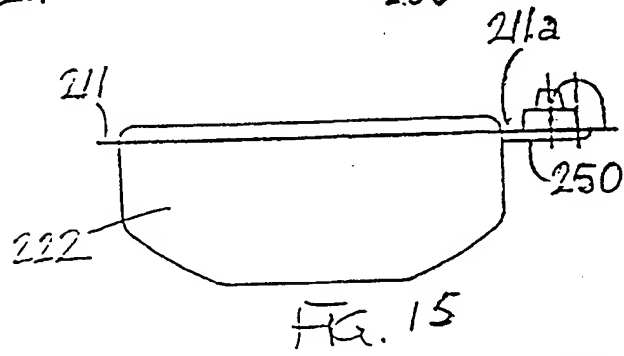
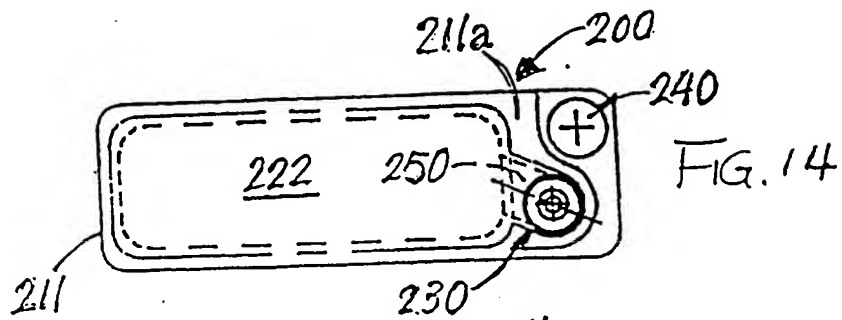


FIG 12a

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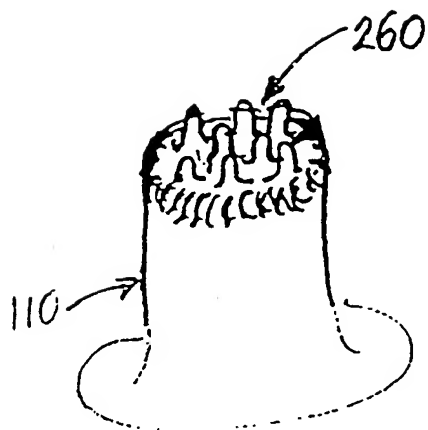


FIG. 18

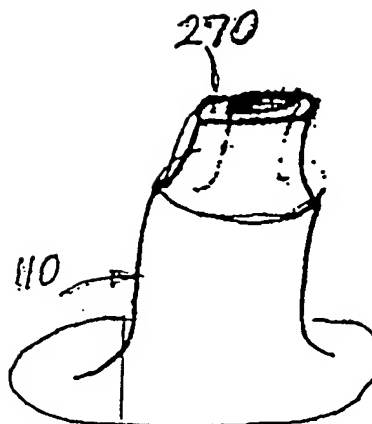


FIG. 19

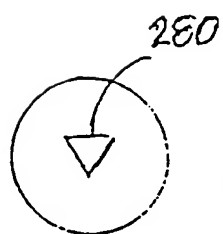


FIG. 20a

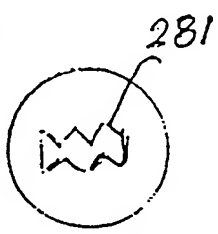


FIG. 20b

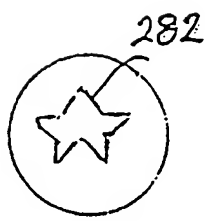


FIG. 20c

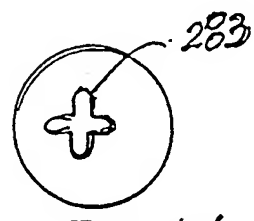
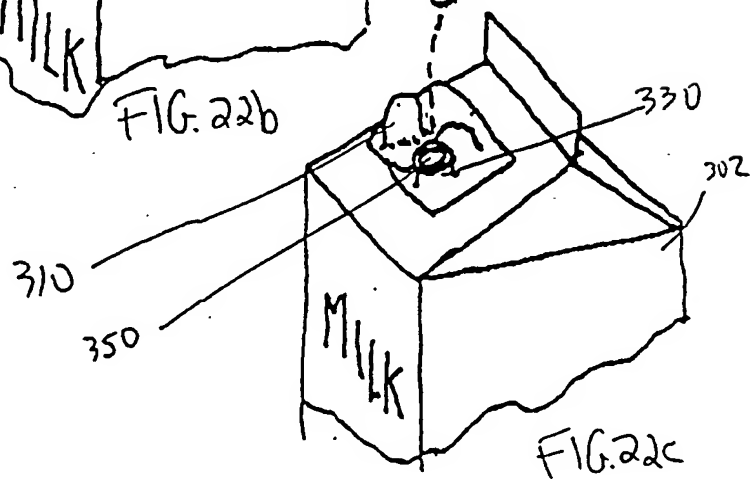
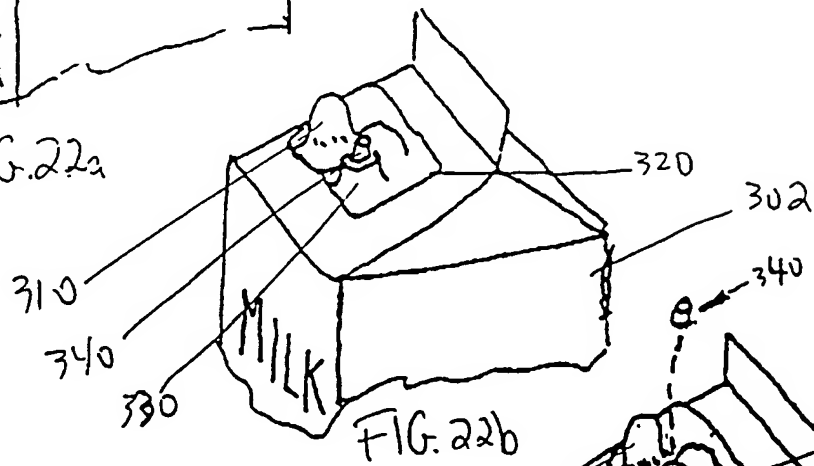
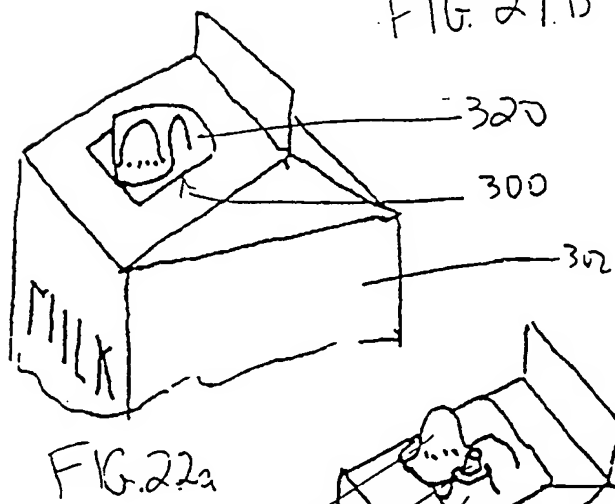
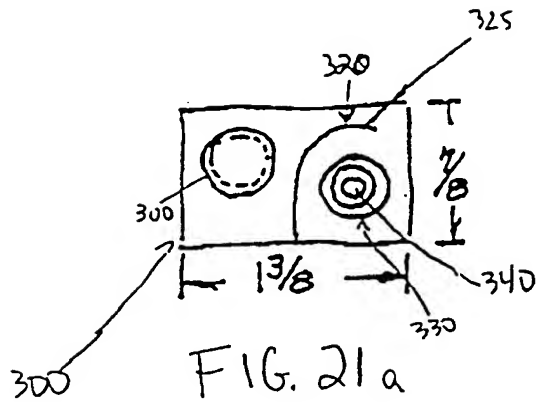


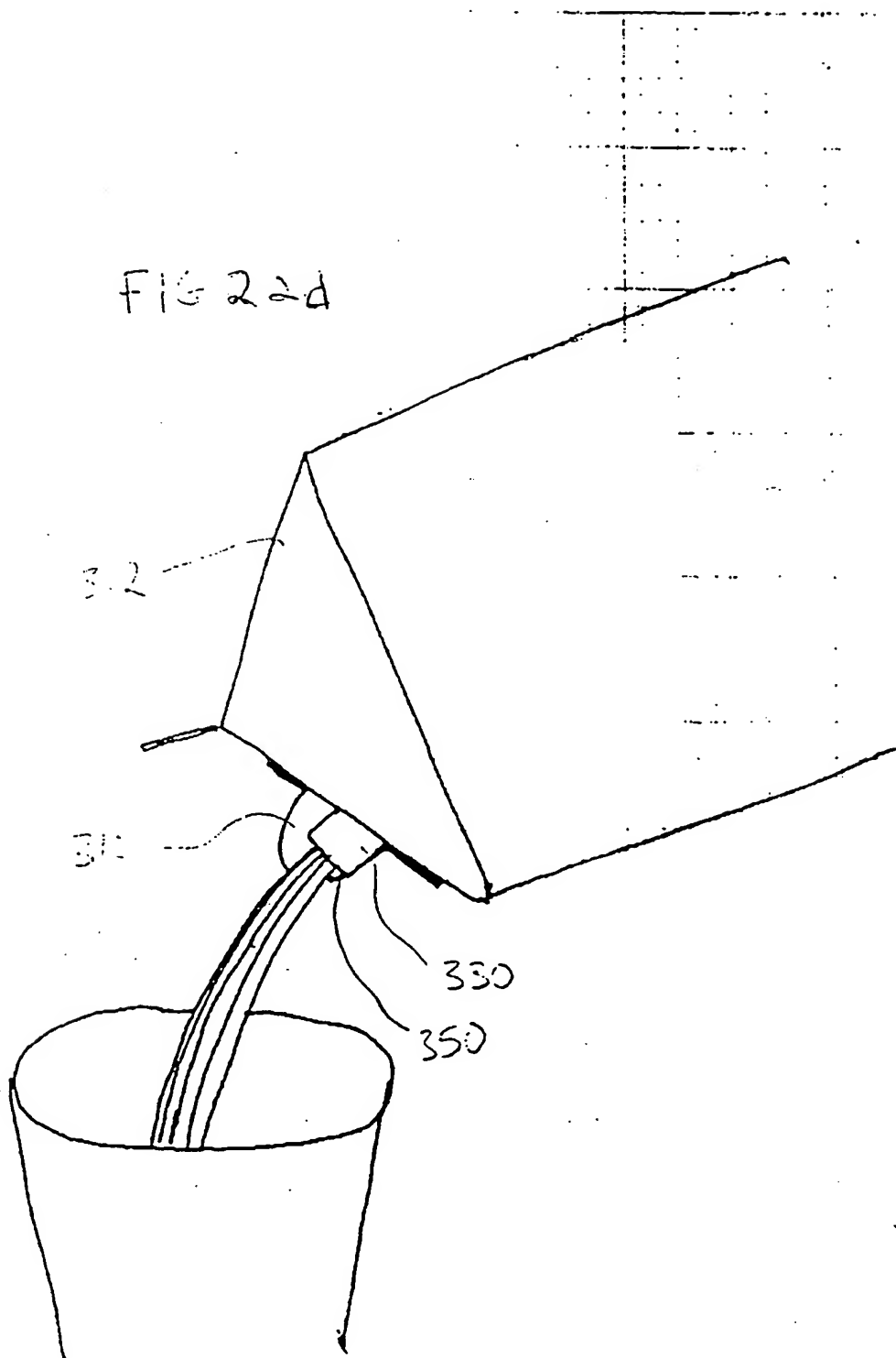
FIG. 20d

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FIG 22d



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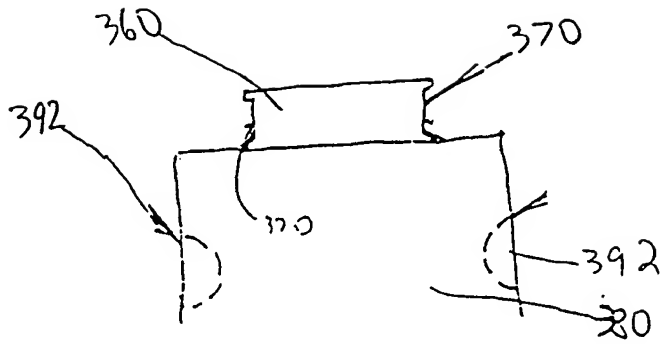


FIG. 23

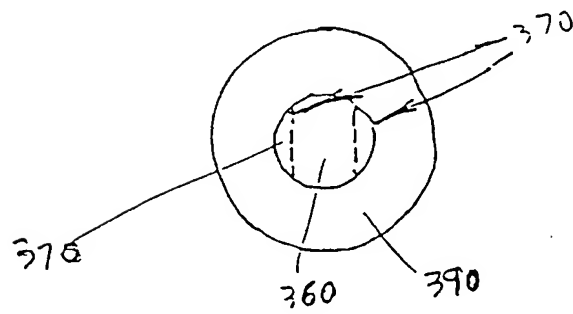


FIG. 24

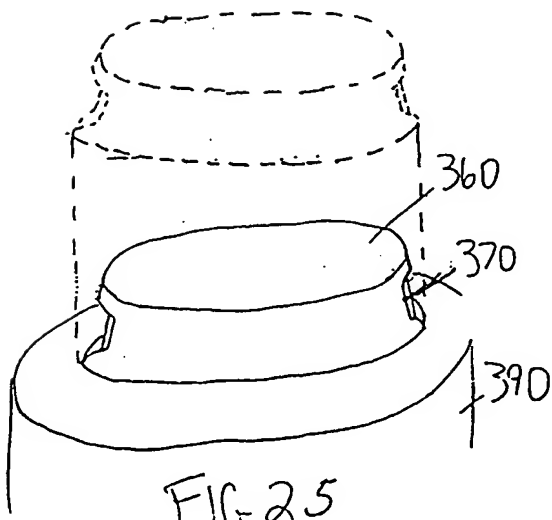


FIG. 25

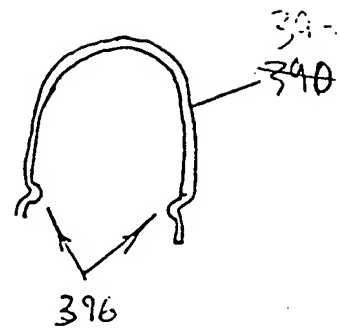


FIG. 26

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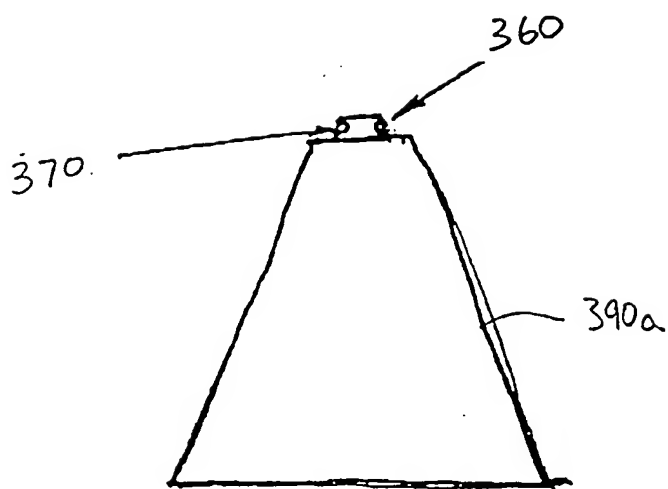


FIG 23a

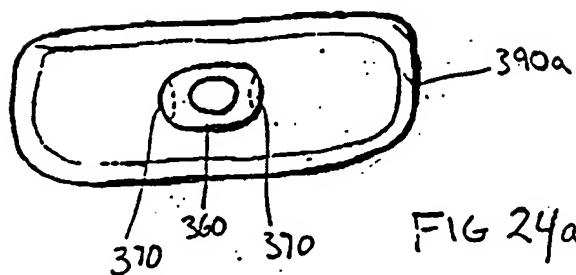


FIG 24a

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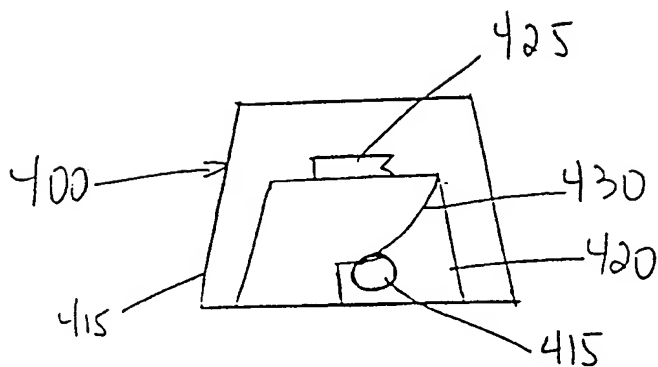


FIG. 27

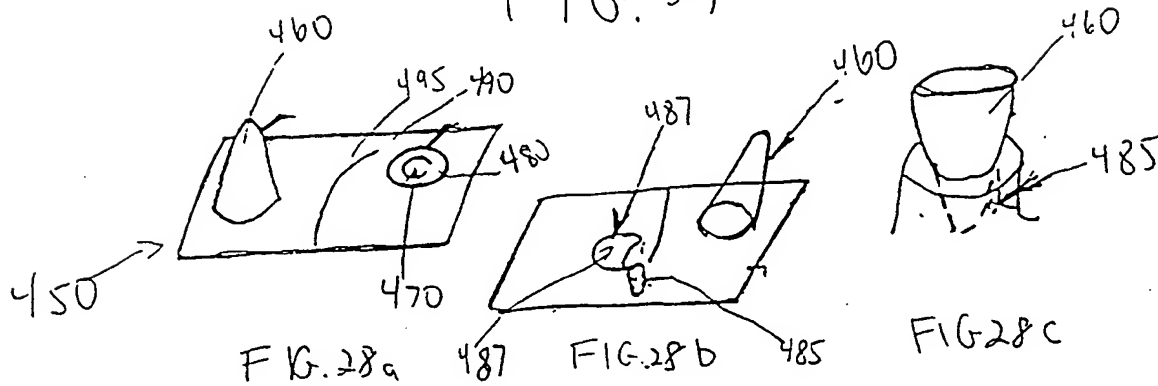


FIG. 28a

FIG. 28b

FIG. 28c

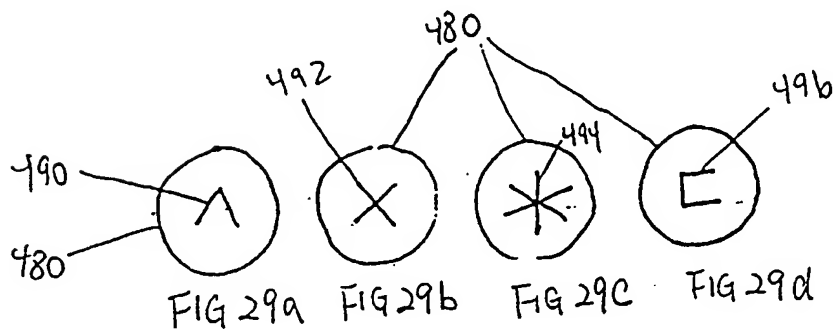


FIG. 29a

FIG. 29b

FIG. 29c

FIG. 29d

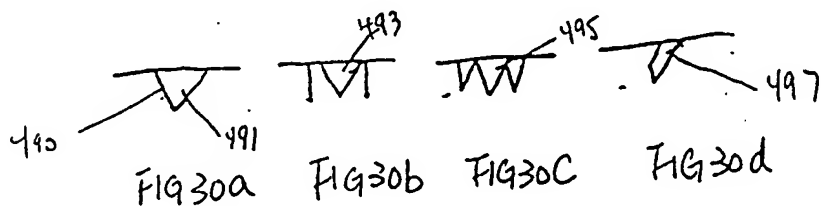


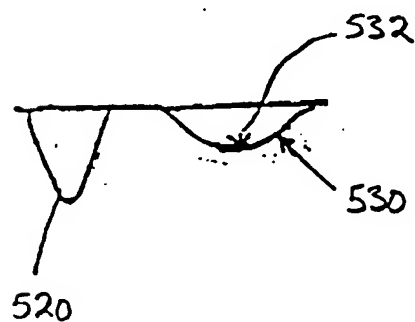
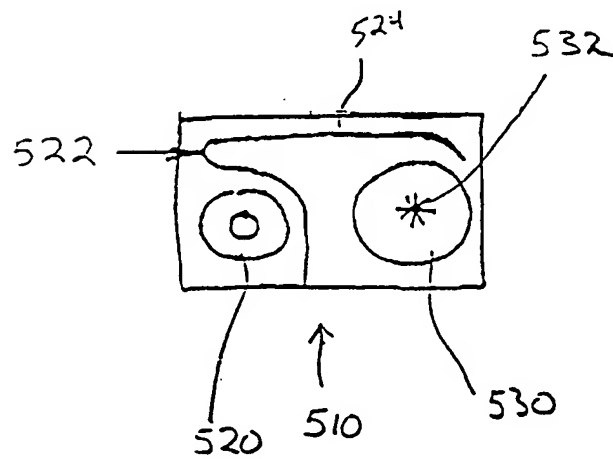
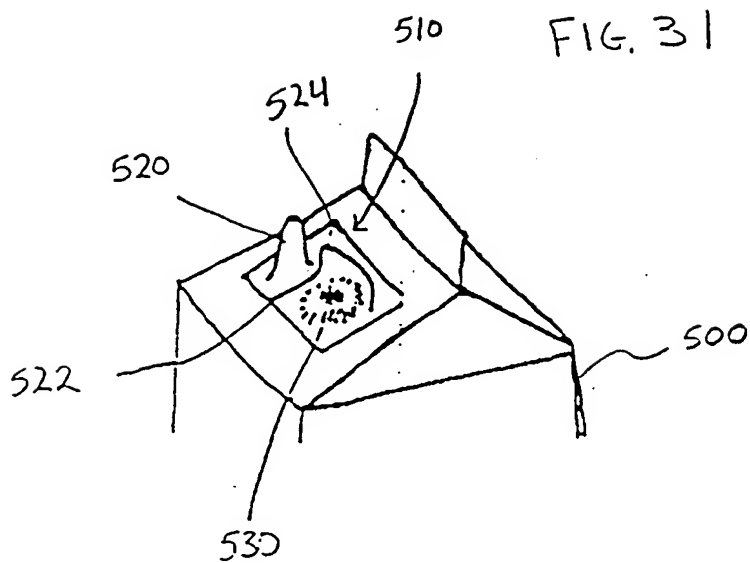
FIG. 30a

FIG. 30b

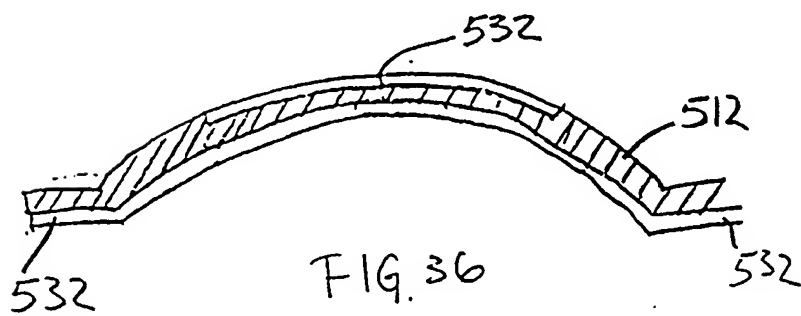
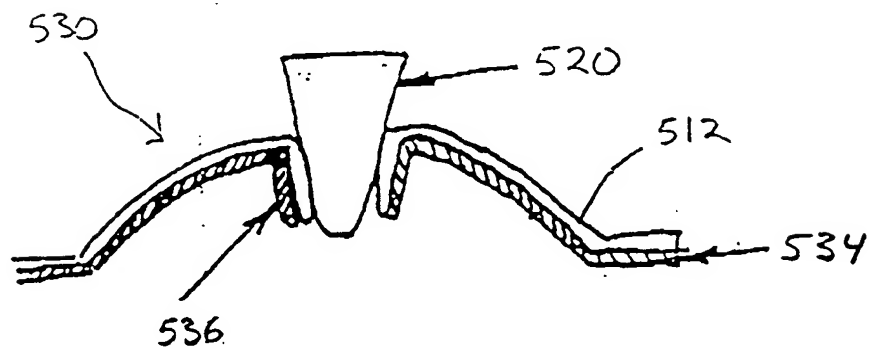
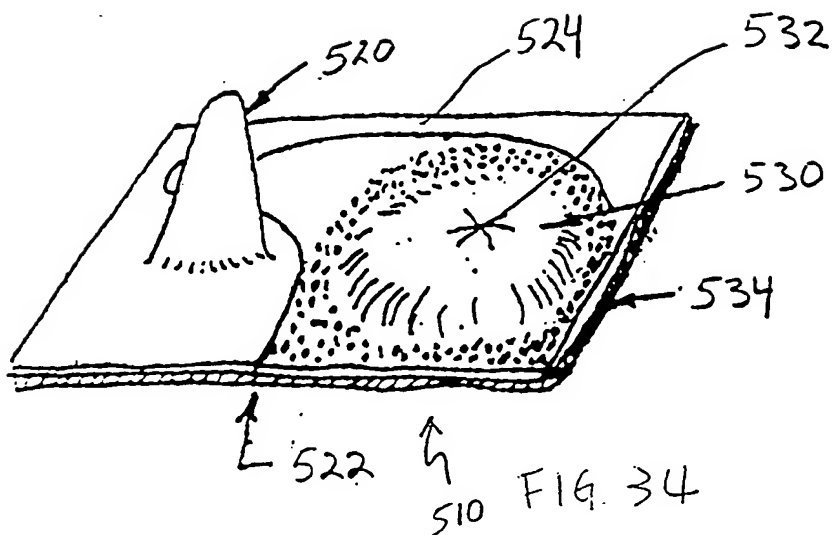
FIG. 30c

FIG. 30d

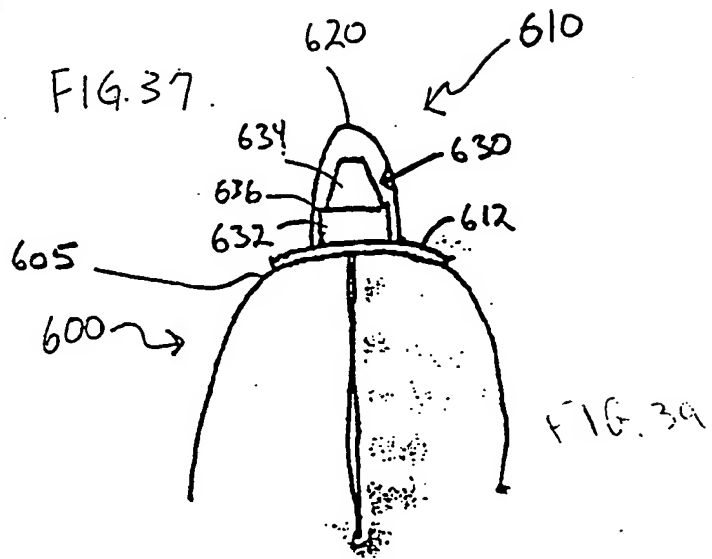
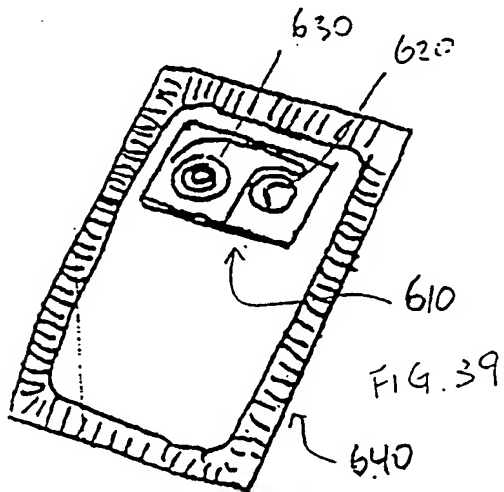
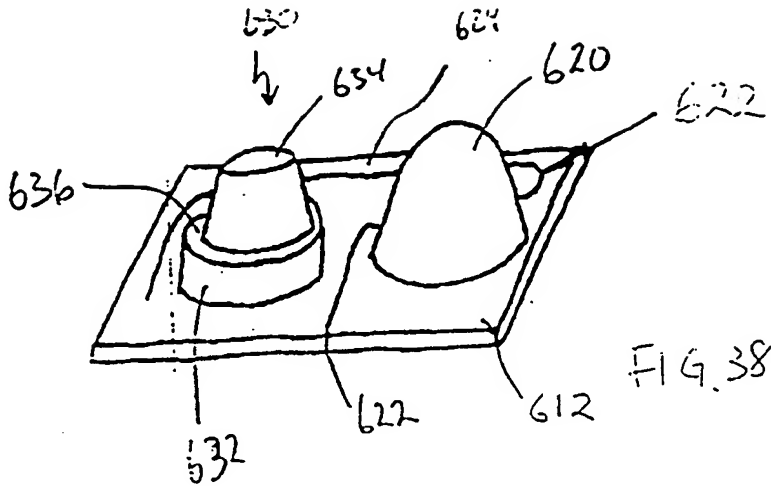
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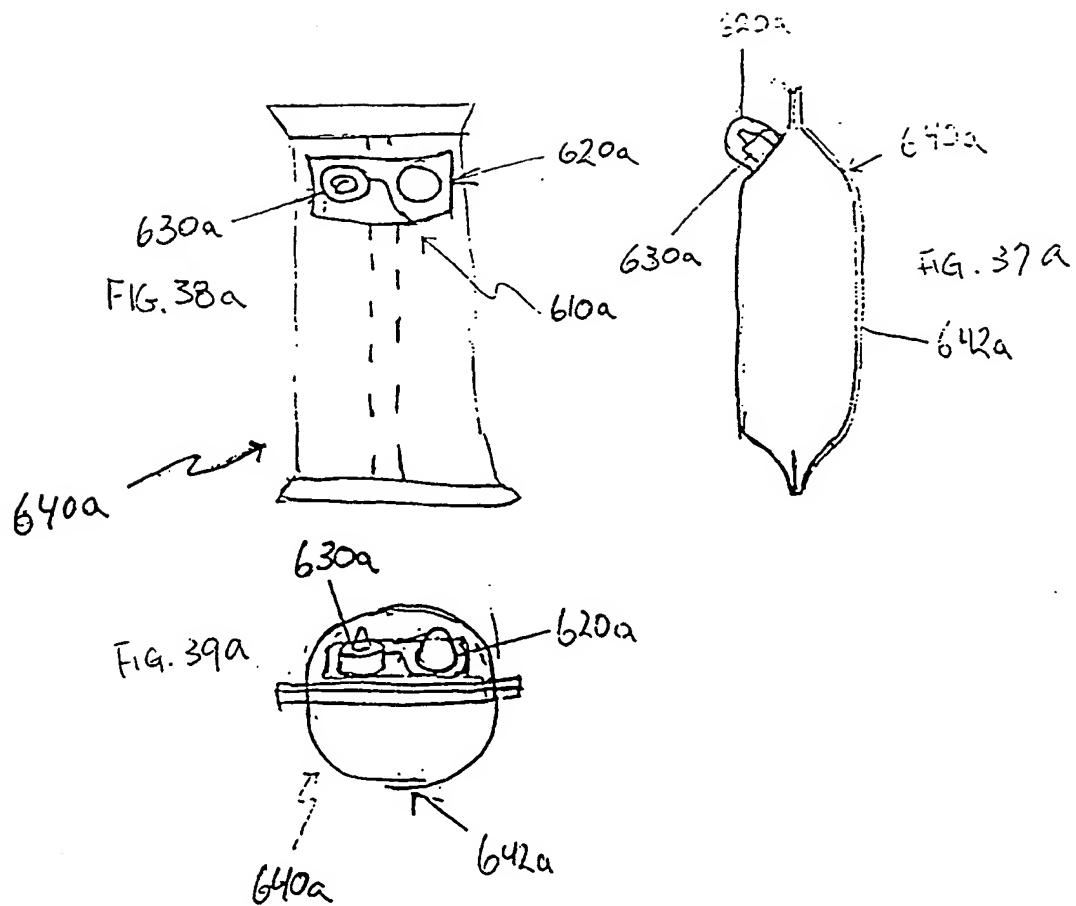
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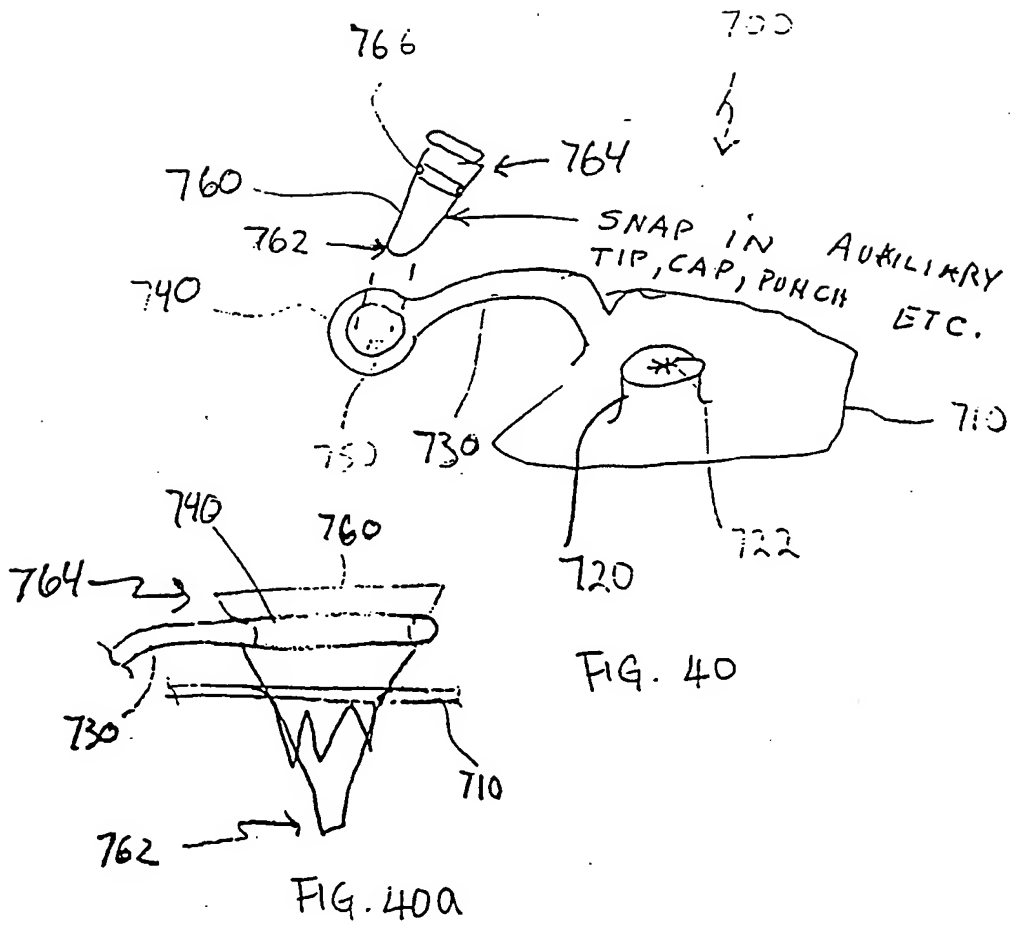


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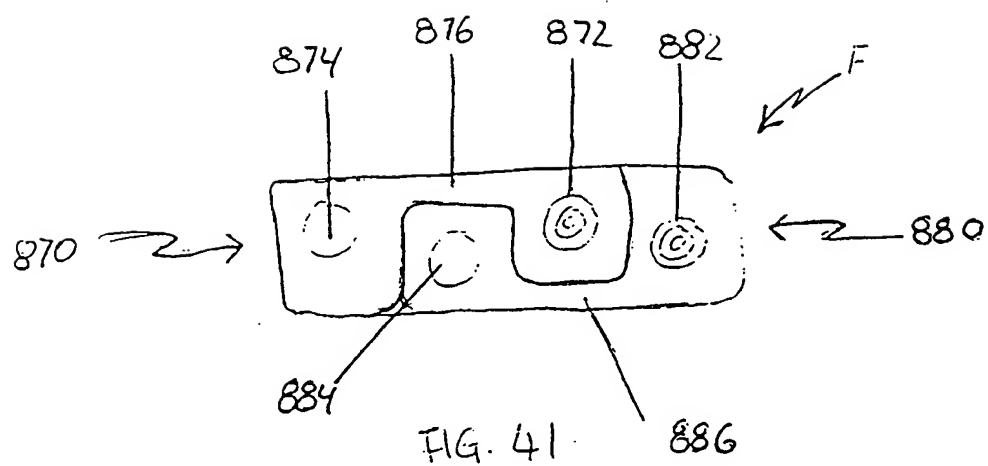


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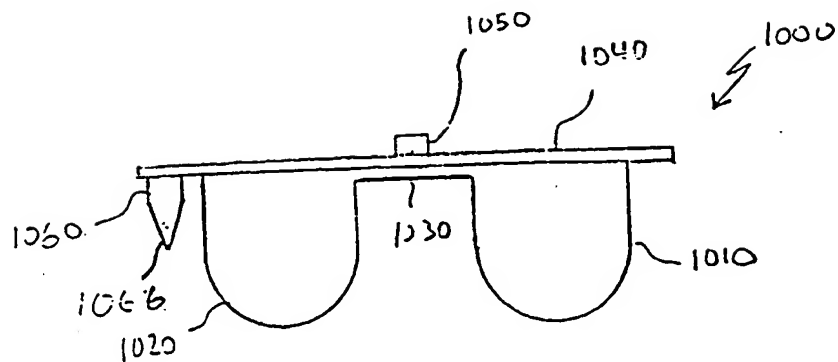


FIG. 42

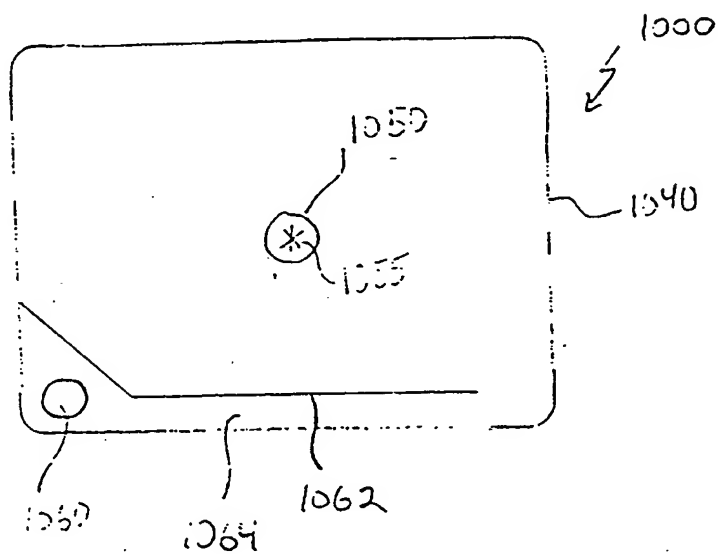


FIG. 43

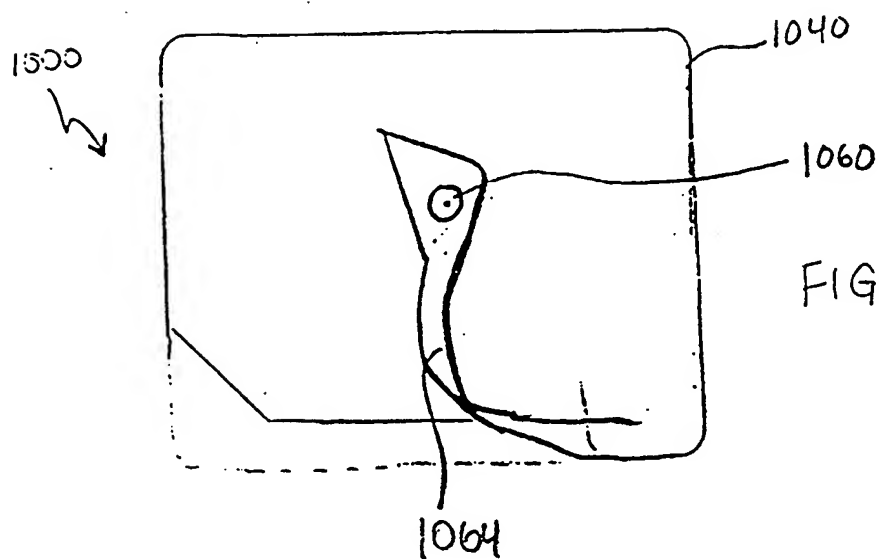
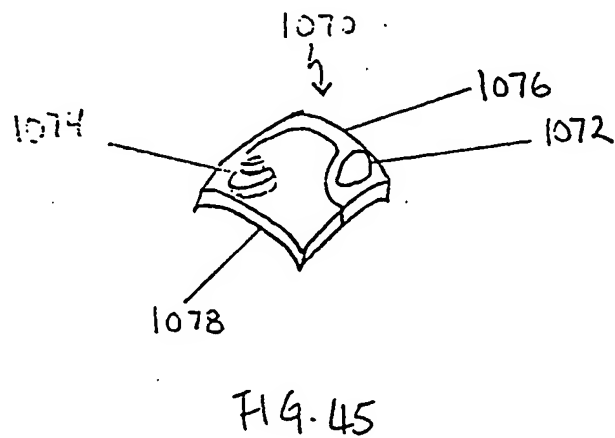
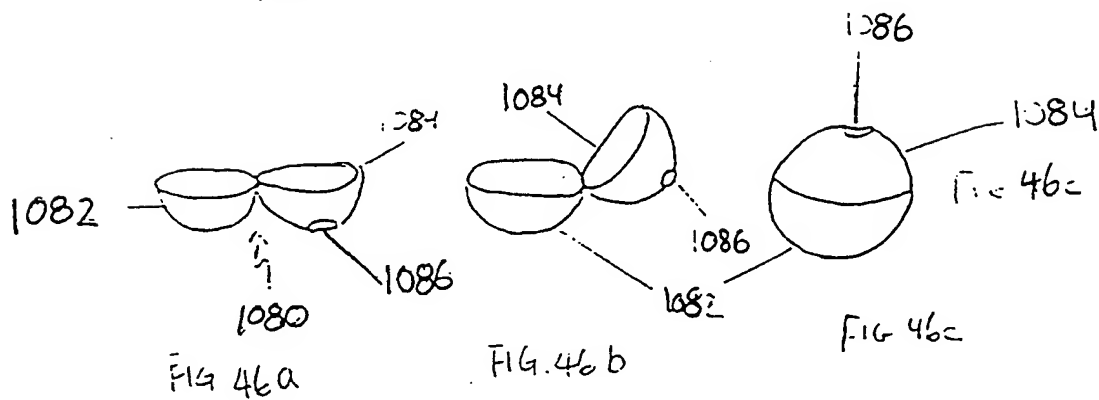
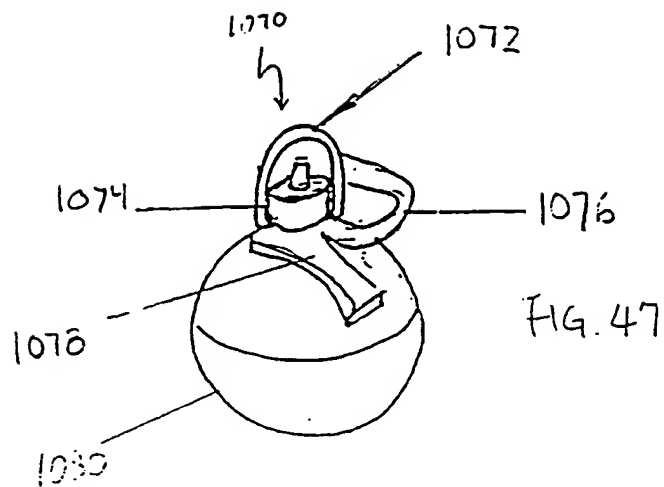


FIG. 44

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FIG. 48

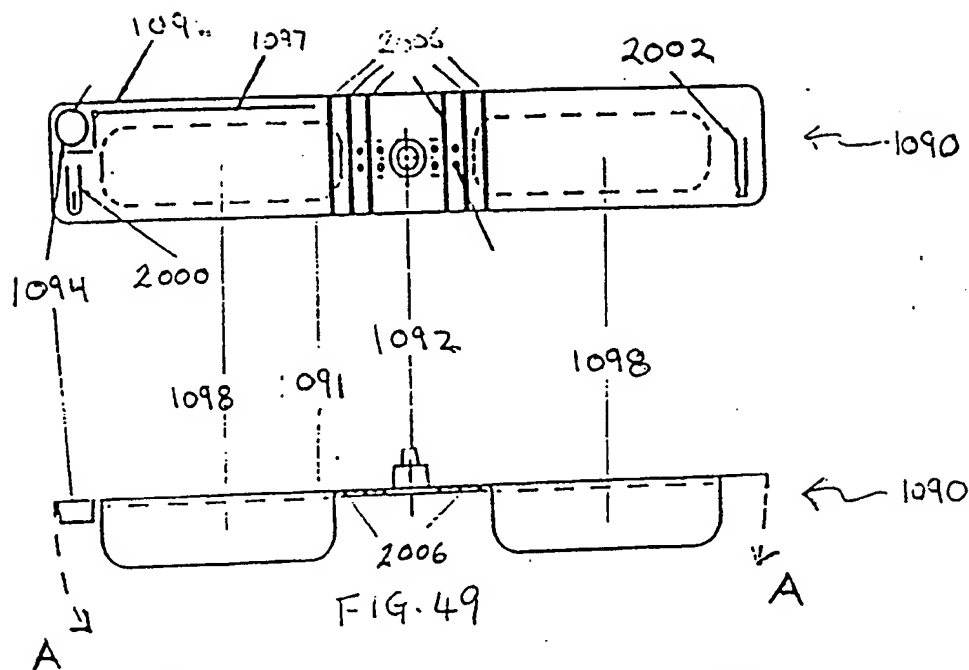


FIG. 49

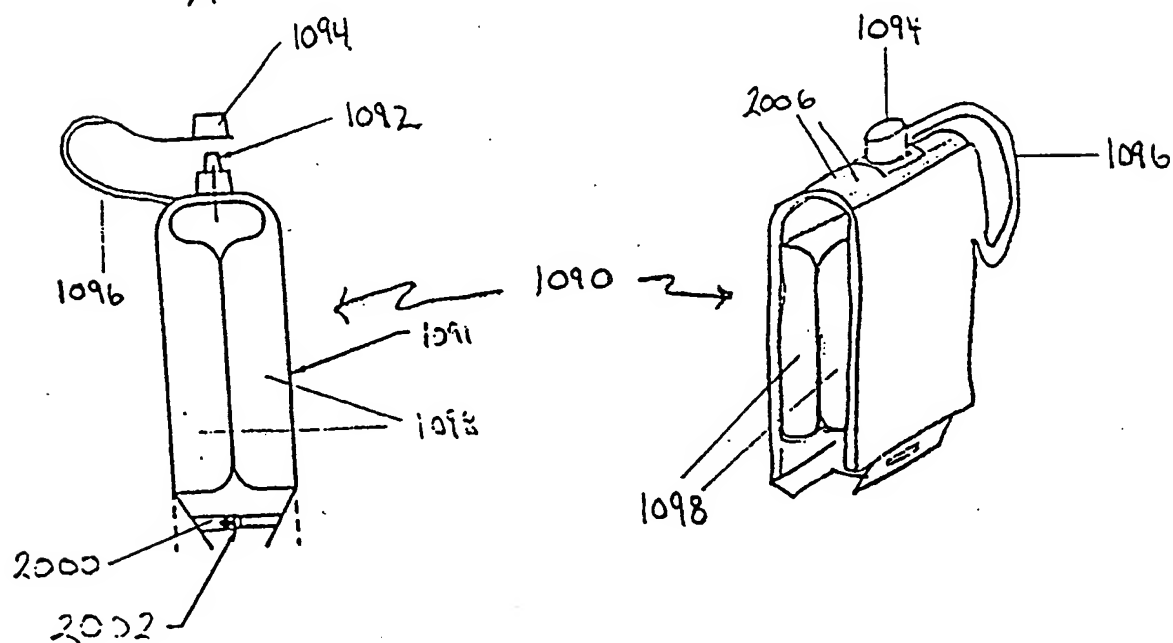


FIG. 50

FIG. 51

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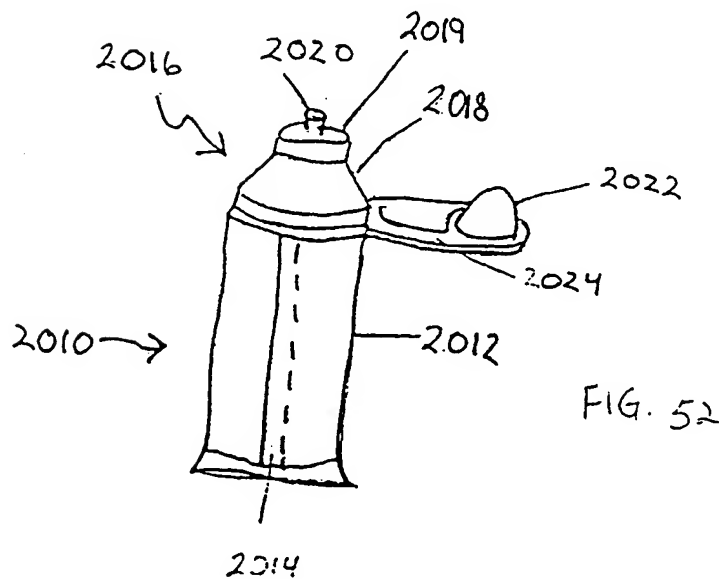
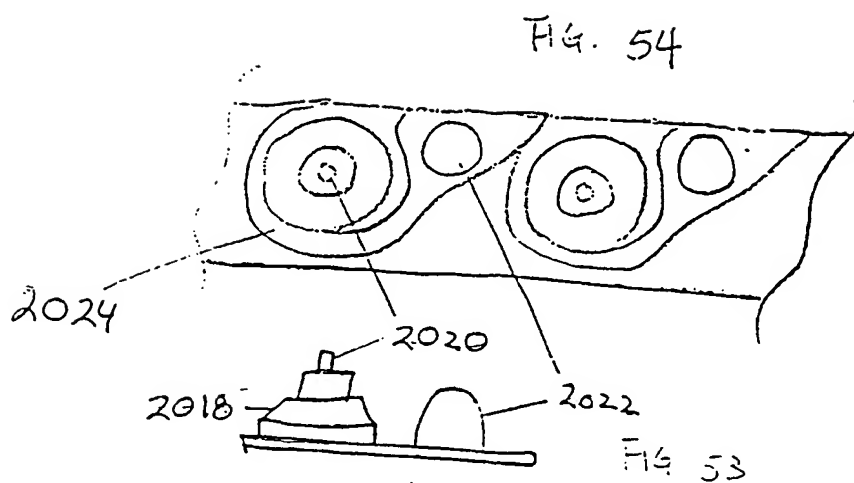


FIG. 55b

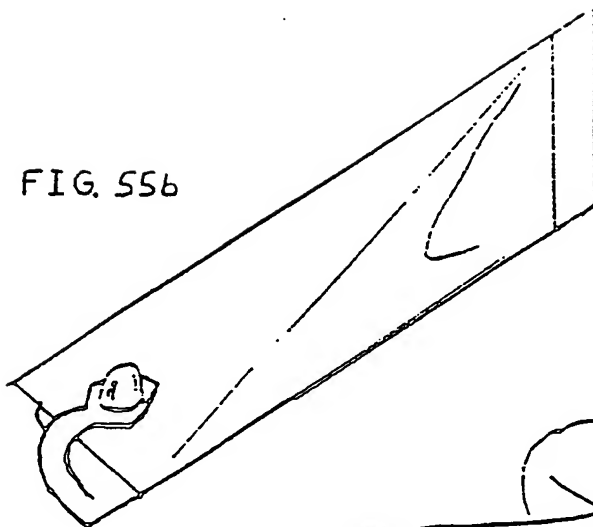


FIG. 55c

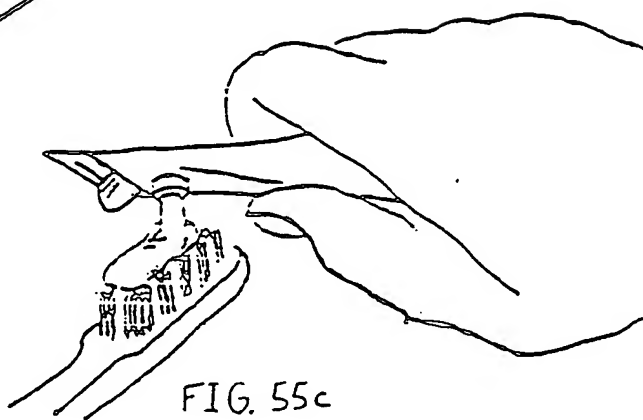
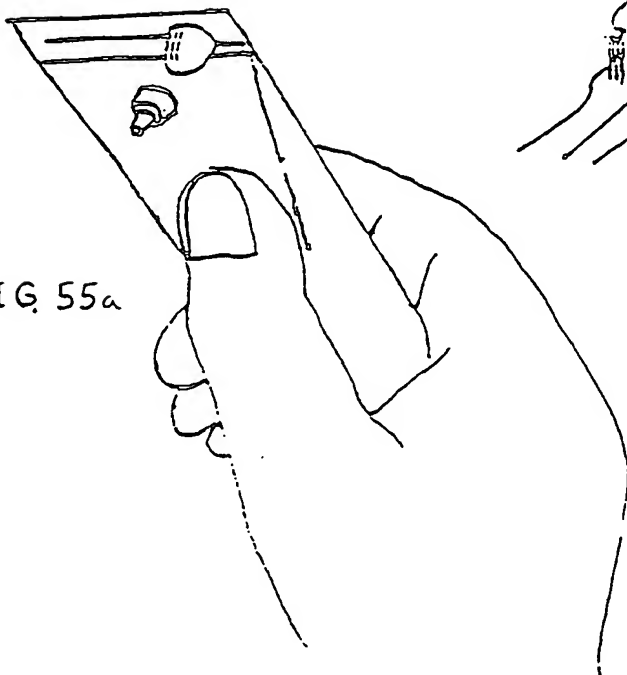
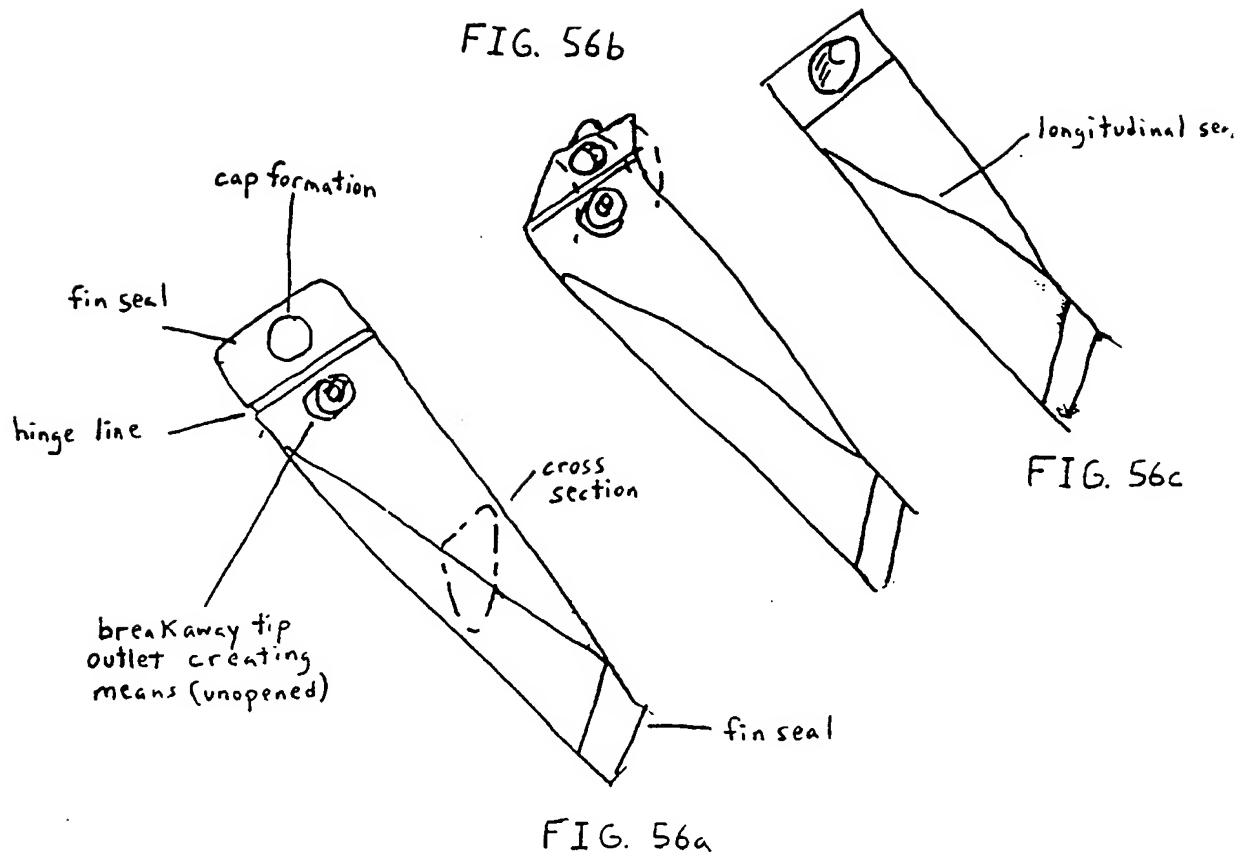


FIG. 55a



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Material: .005" thick Barex
w. 6 lbs. of PVDC
25 ml tetrahedral tube

FIG. 57b

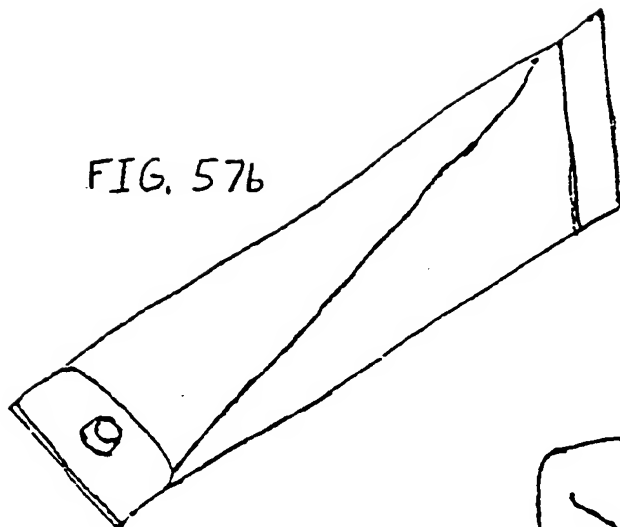


FIG. 57a

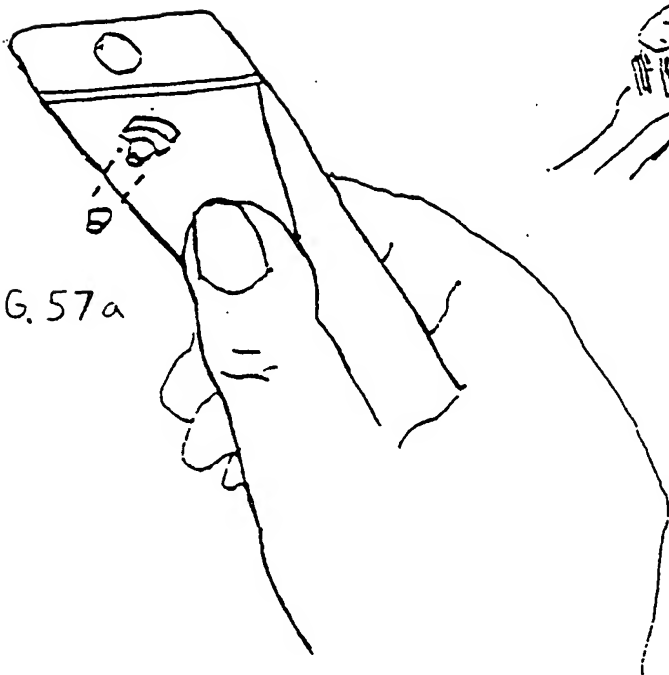
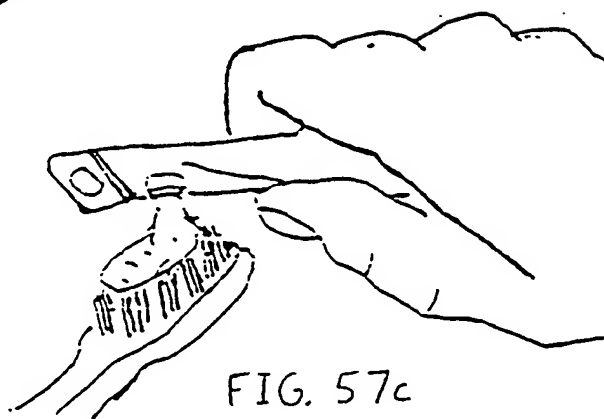


FIG. 57c



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FIG. 58a

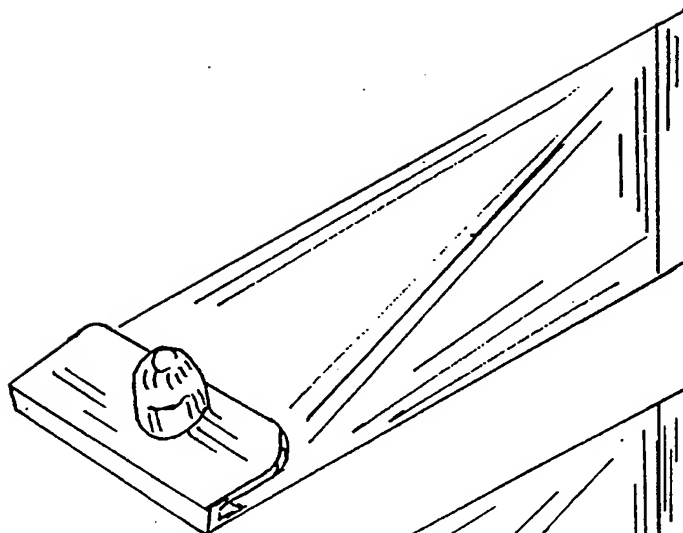


FIG. 58b

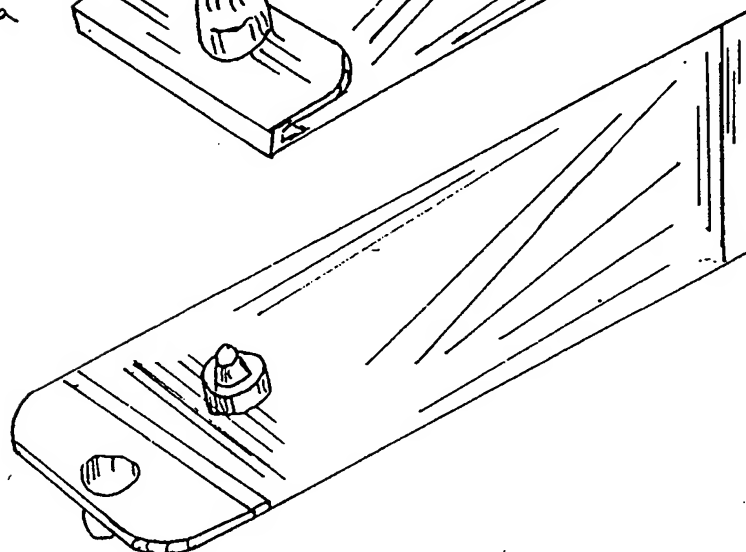
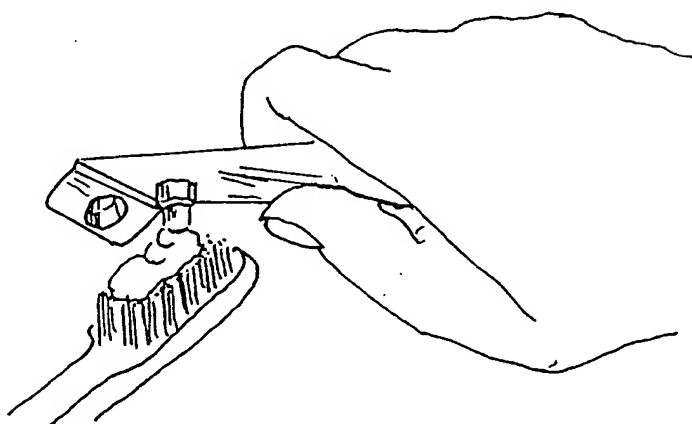
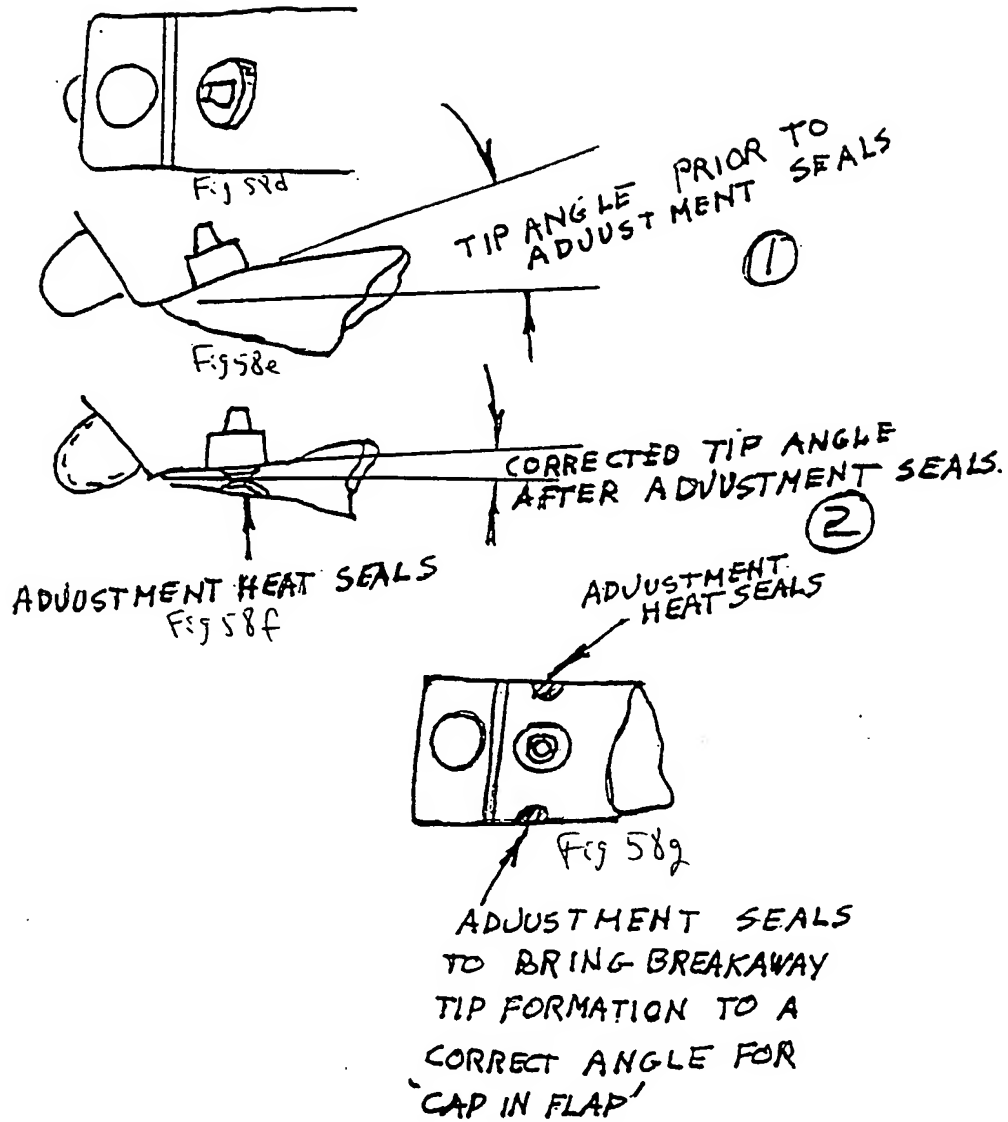


FIG. 58c

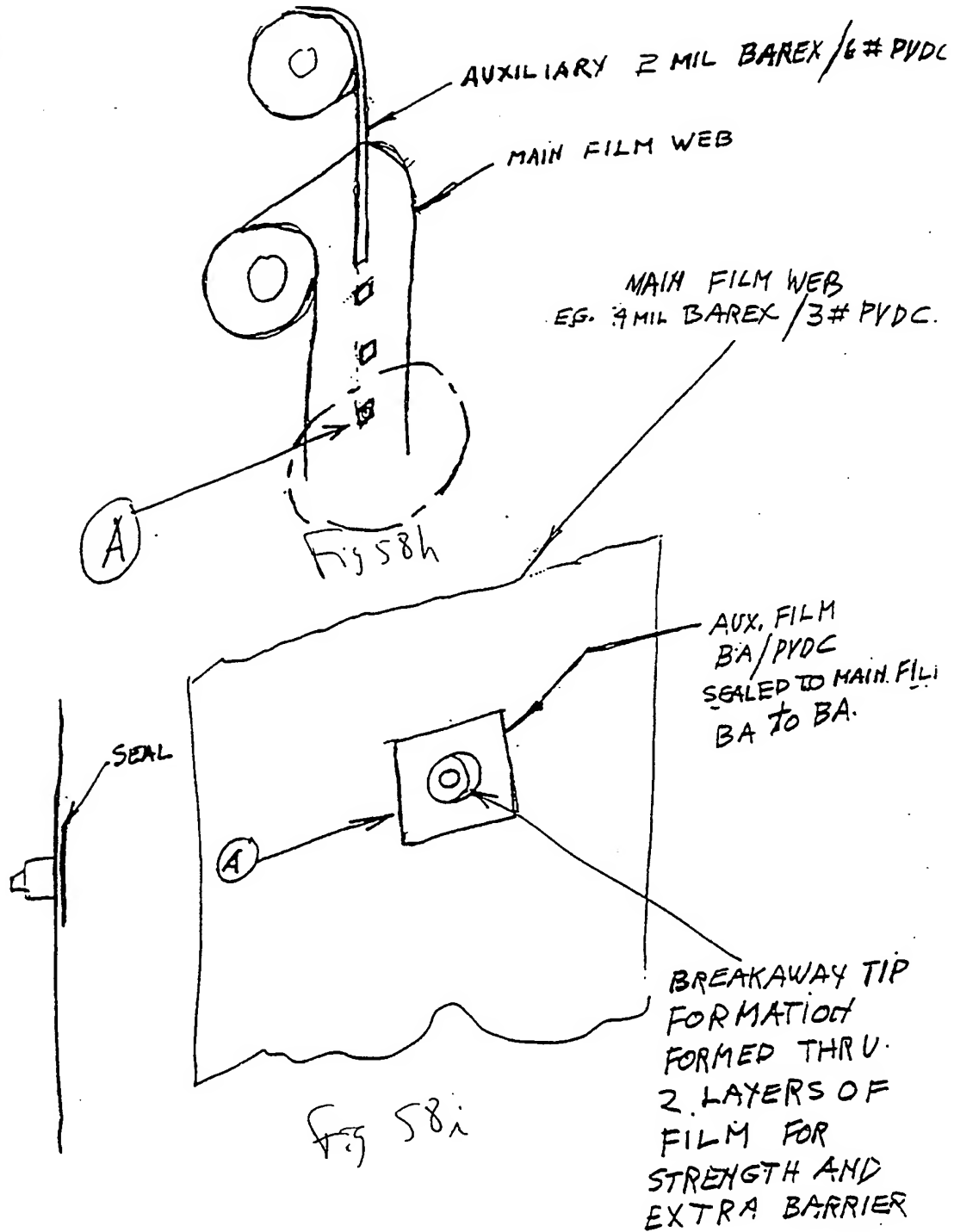


REDMOND



Sanford Nelson
Mar. 9, 1998.

REDMOND



Samuel P. Ralston
Mar. 10, 1998.

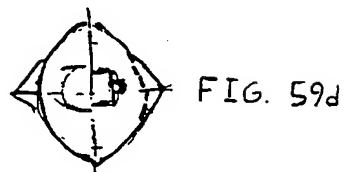
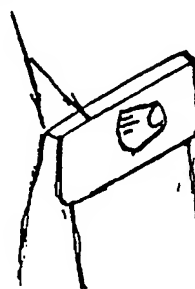
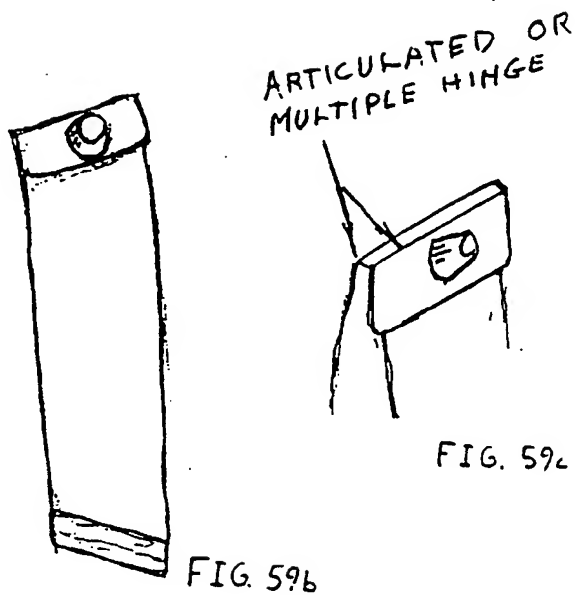
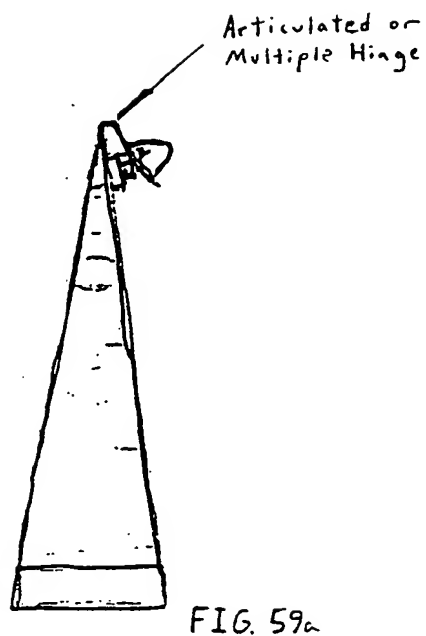


FIG. 60a

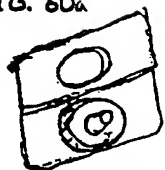


FIG. 60b

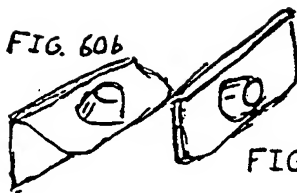


FIG. 60c



INDEPENDENT EASY OPENING
BREAKAWAY TIP WITH HINGED
CAP FOR ADHESION TO OTHER PACKAGINGS
MADE OF THERMO-FORMABLE PLASTIC

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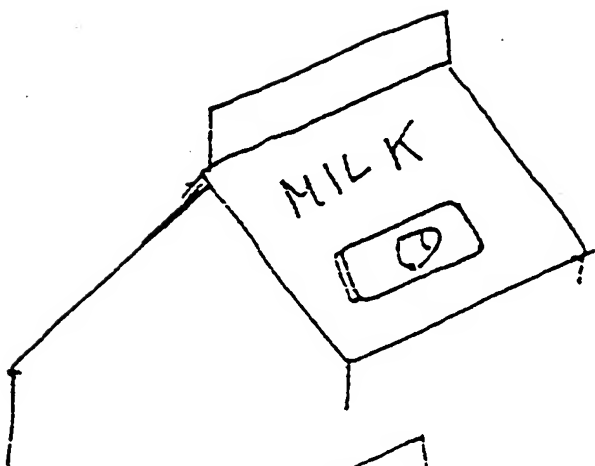


FIG. 61c

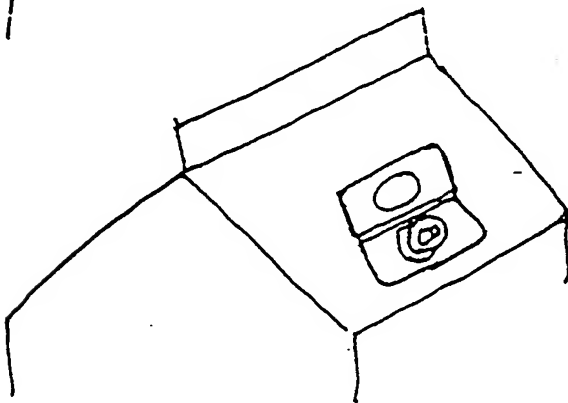


FIG. 61b

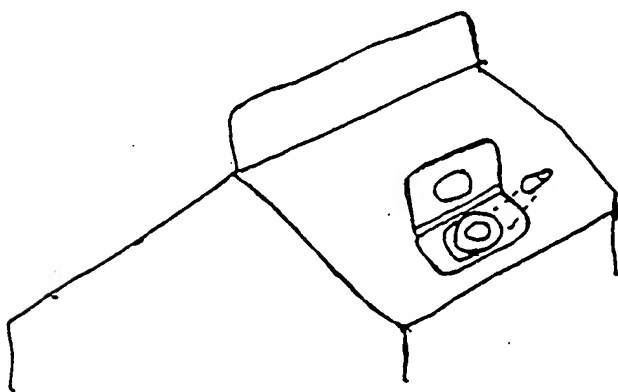
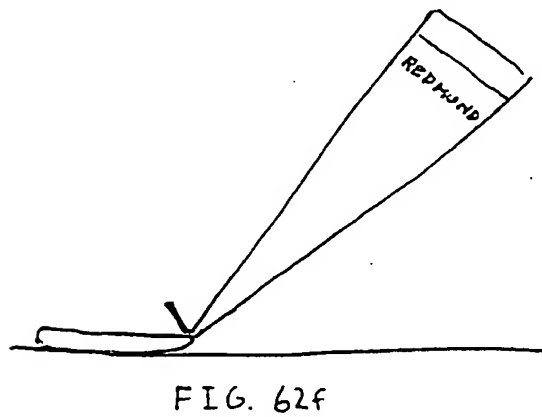
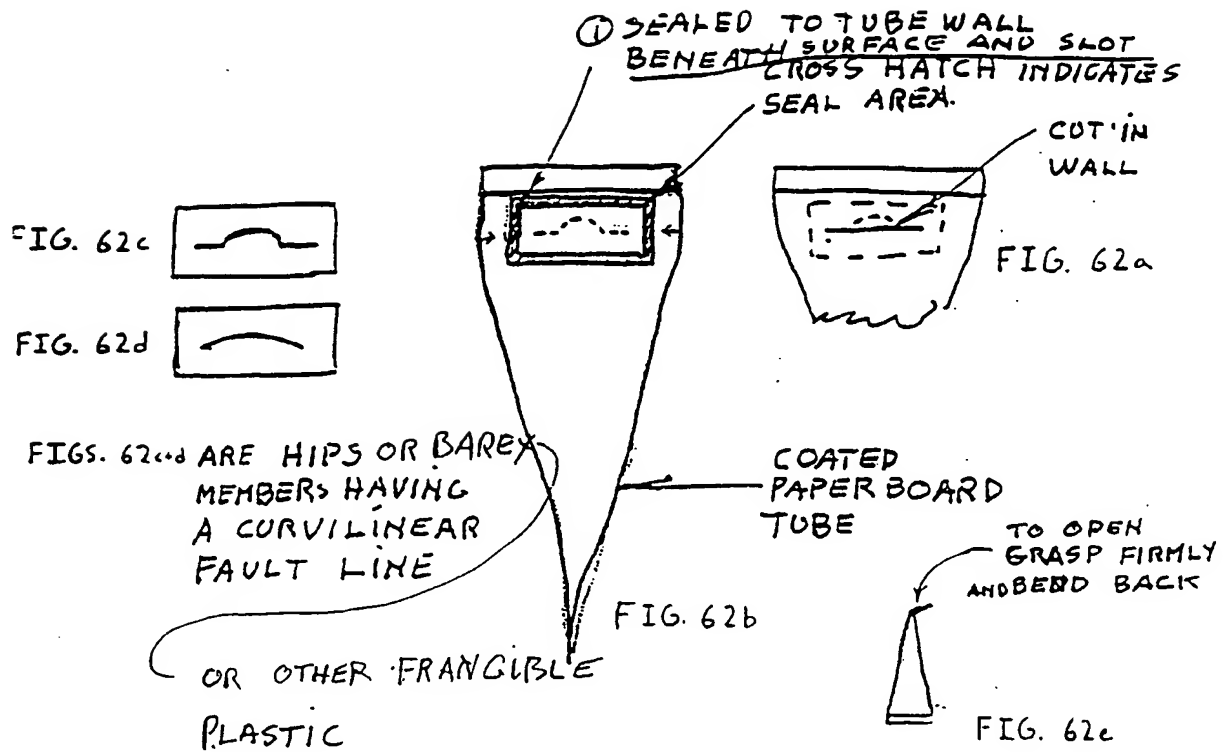
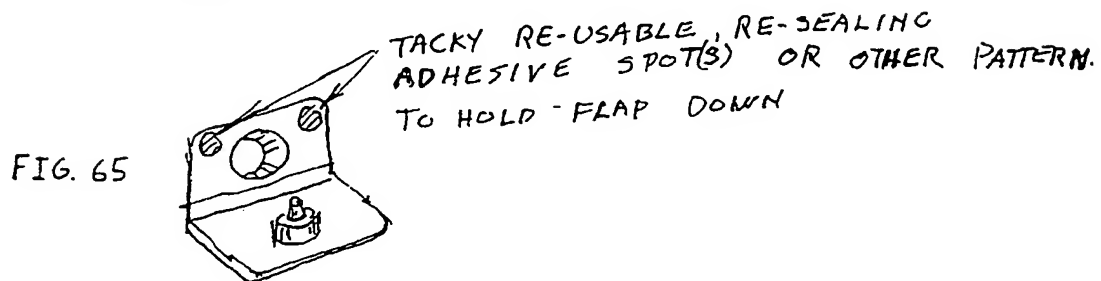
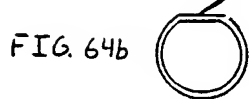
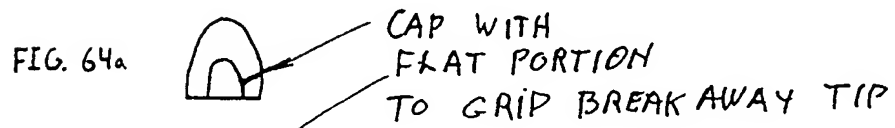
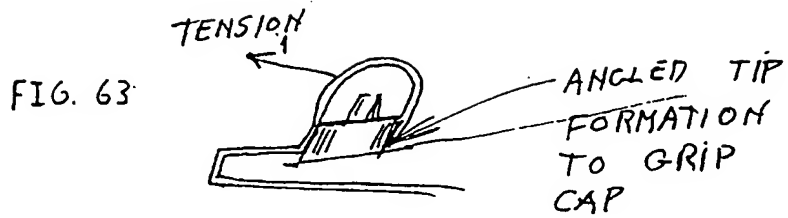


FIG. 61a

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Sanford Redund
Feb. 10, 1997



Sealed Release

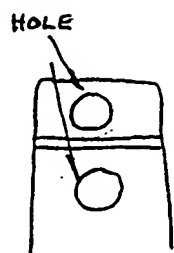


FIG. 66a



FIG. 66b



FIG. 66c

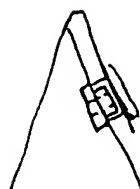
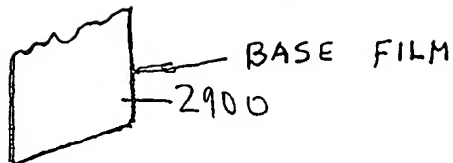


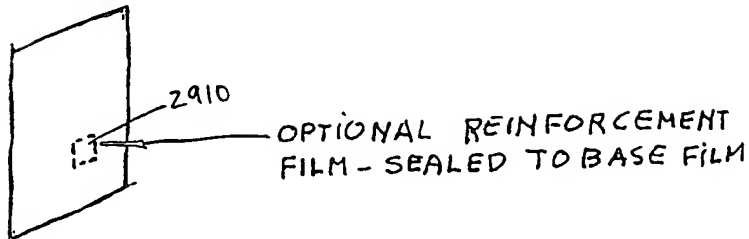
FIG. 66d



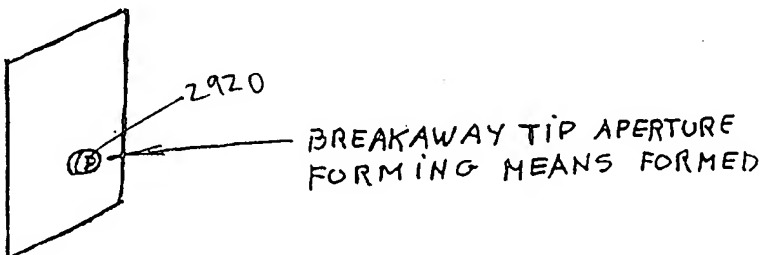
① Fig. 67a



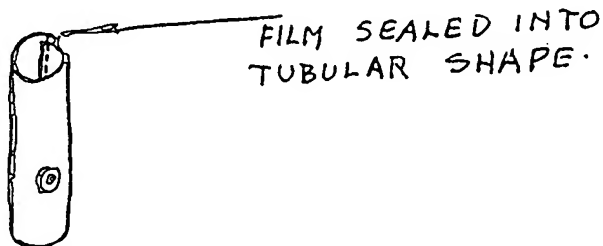
② Fig. 67b



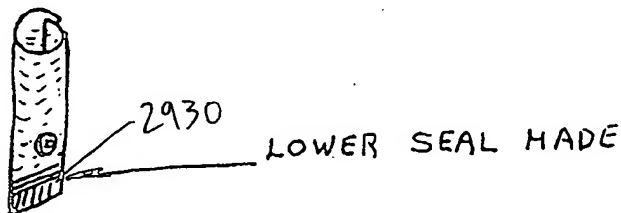
③ Fig. 67c



④ Fig. 67d



⑤ Fig. 67e



⑥ Fig. 67f

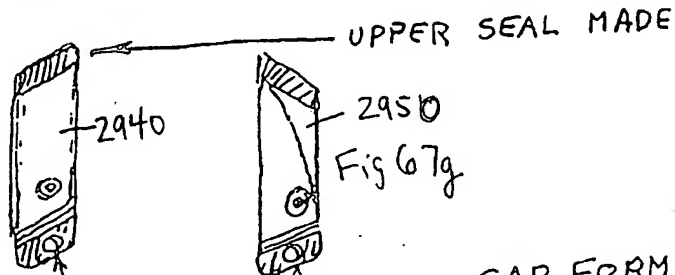


Fig. 67g



REDMOND TUBE

METHOD SEQUENCE

FLAT STYLE

TETRAHEDRAL STYLE

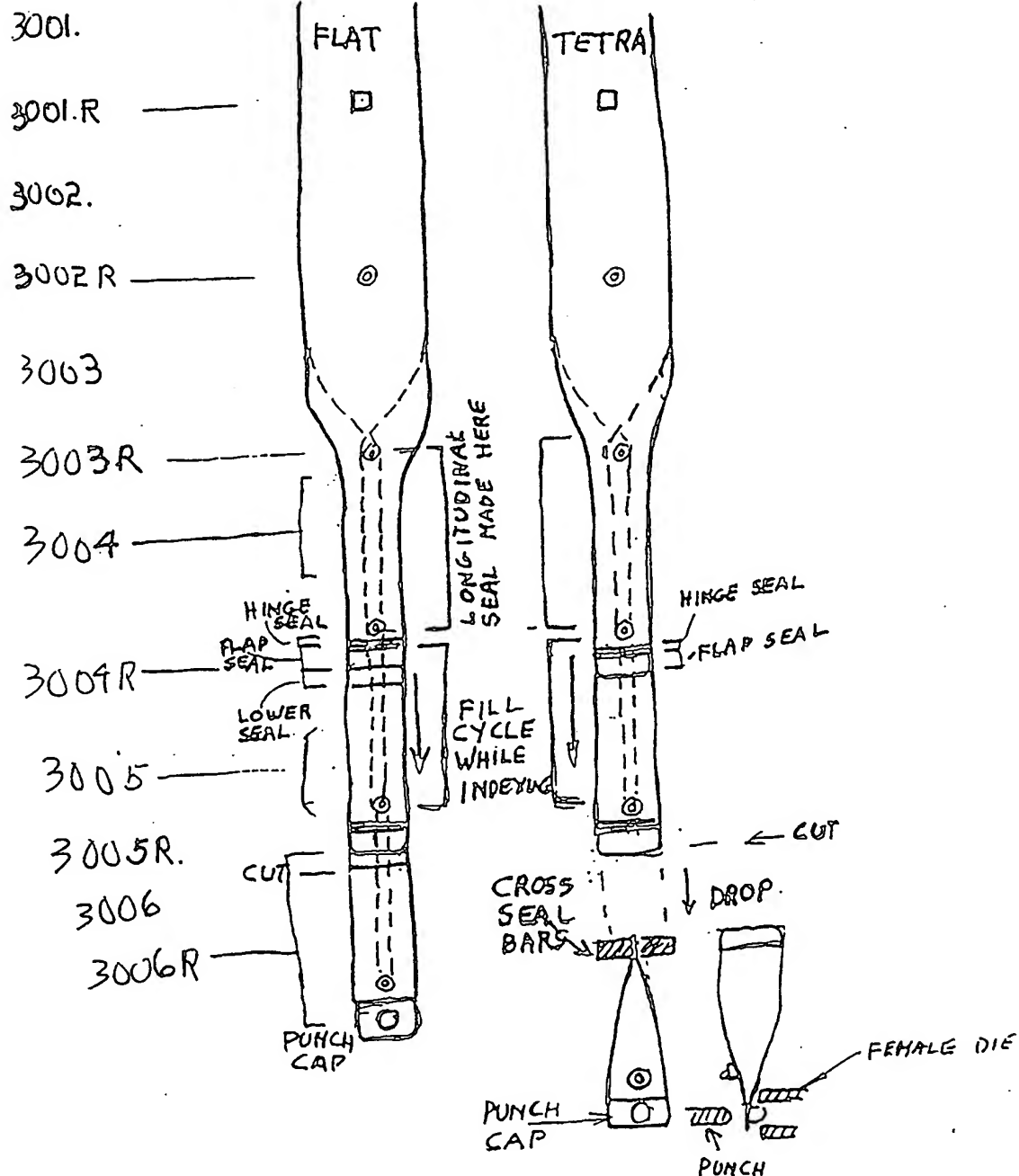
FIGURE 67

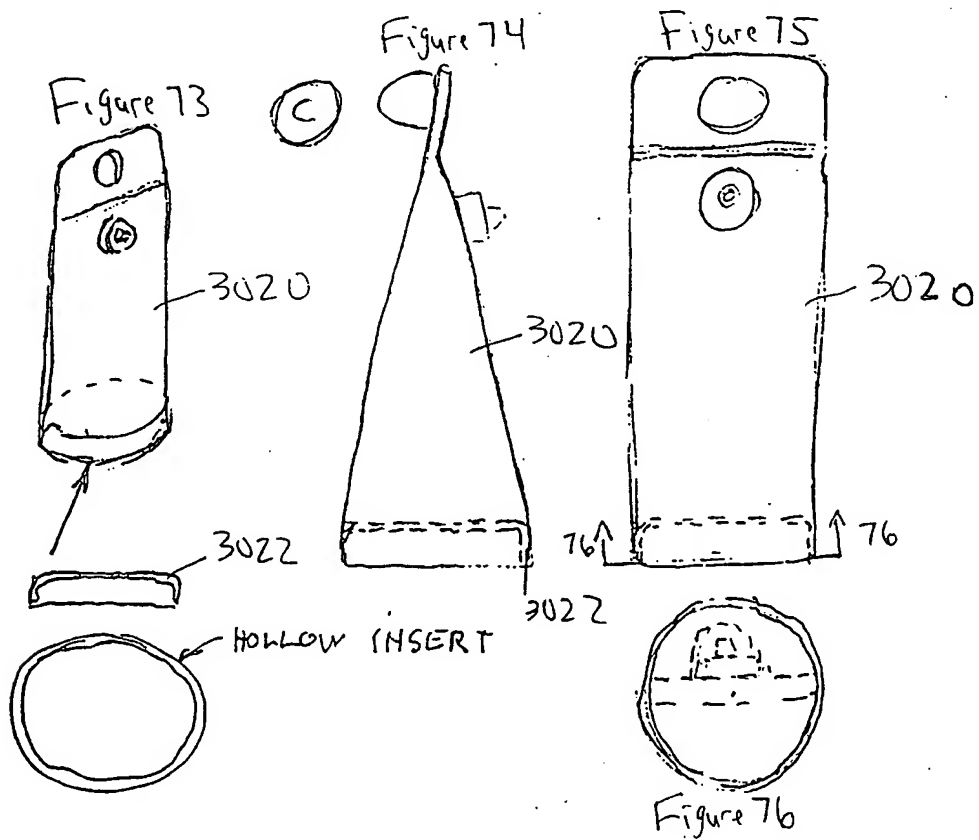
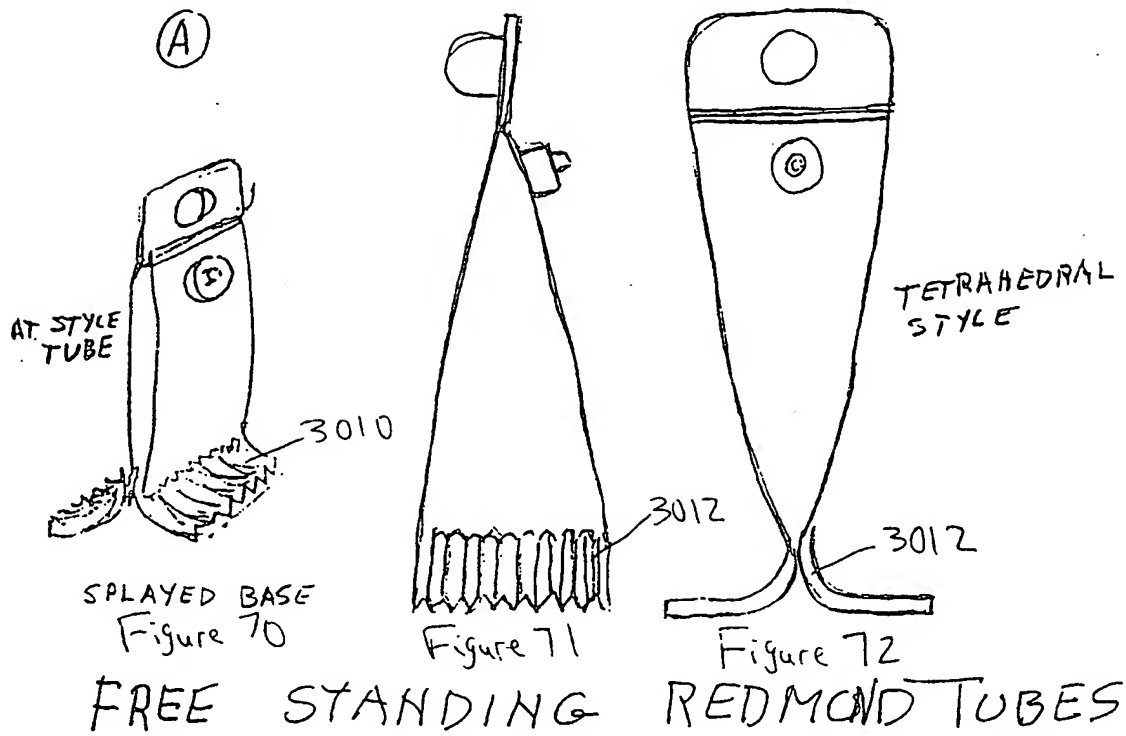


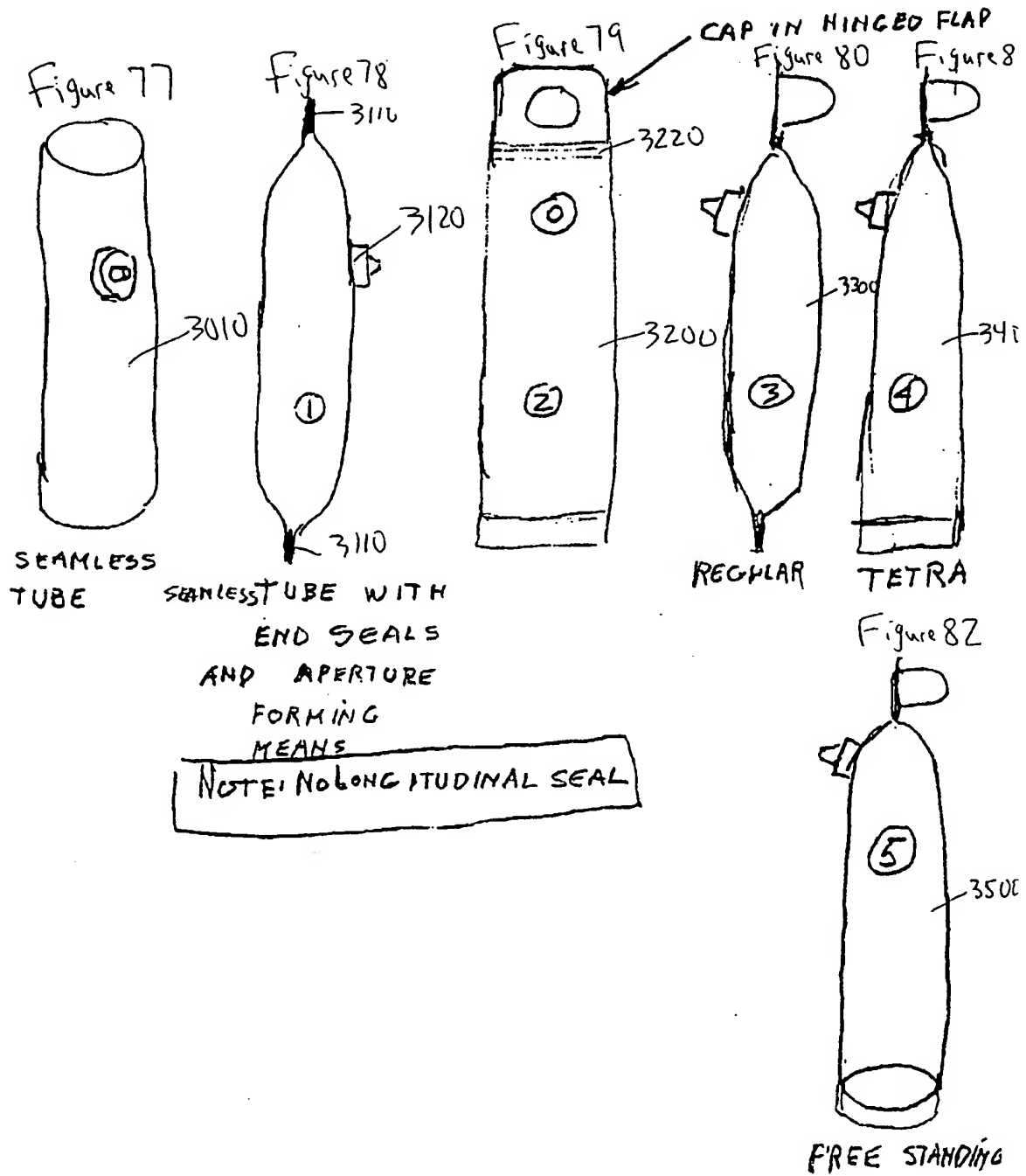
SEQUENTIAL FABRICATION DIAGRAMS FOR REDMOND TUBES

FIGURE 68

FIGURE 69







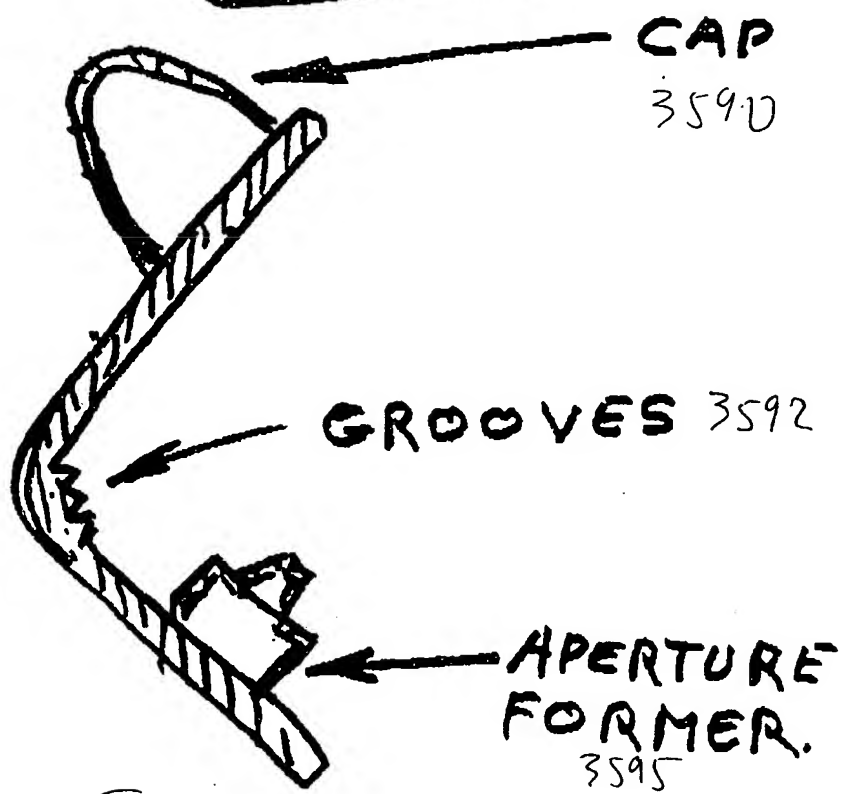
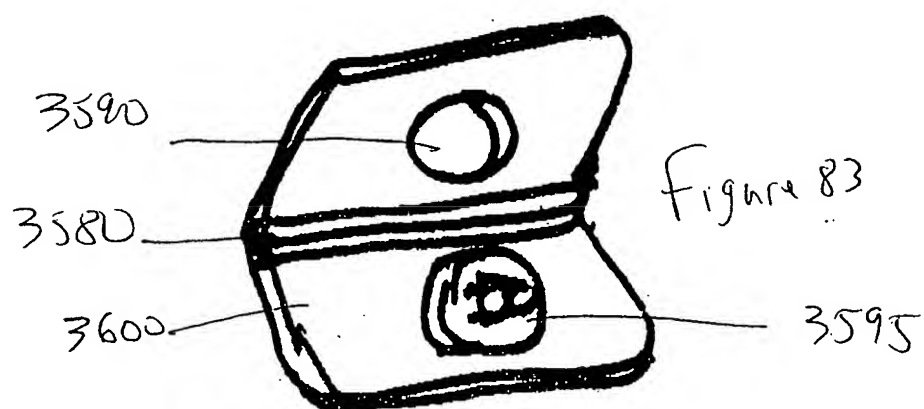


FIGURE 84

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/05809

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : B65D 35/08

US CL : 222/107, 543; 220/375

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 222/107, 543; 220/375

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category ^o	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- A	US 4,470,521 A (SCAMMELL) 11 September 1984, see the entire document.	1-4, 24, 27,28,29, 31,32 ----- 1-32
A	US 4,756,442 A (HALM ET AL.) 12 July 1988, see the entire document.	1-32

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
B earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*A* document member of the same patent family
O document referring to an oral disclosure, use, exhibition or other means	
P document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

06 JUNE 1999

Date of mailing of the international search report

06 JUL 1999

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

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Telephone No. (703) 308-1115